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BETTER BUSINESS ∴ BETTER FARMING ∴ BETTER LIVING

HINTS FROM A PRACTICAL FARMER

TO THE

SETTLERS ON THE PROJECTS

OF THE


UNITED STATES RECLAMATION SERVICE

I. D. O'DONNELL

SUPERVISOR OF IRRIGATION, U. S. R. S.



WASHINGTON
GOVERNMENT PRINTING OFFICE
1918



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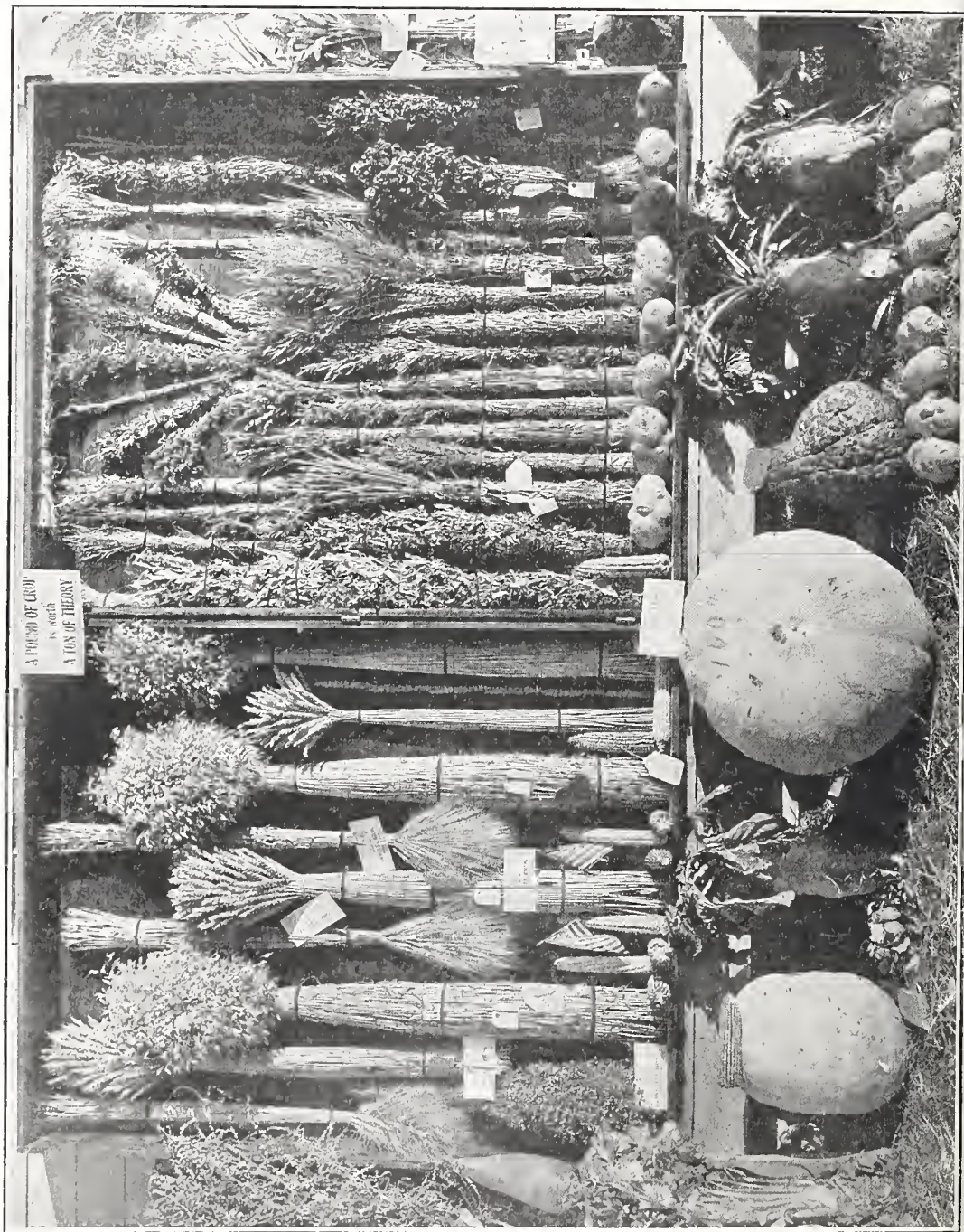
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Dairy cows on a reclamation project.

FOREWORD.

BETTER BUSINESS ON THE FARM.

The advancement of the interests of the farmers in any country depends upon the adoption and the application of the principles of the formulæ—better business, better farming, and better living.

I put the formulæ in the order of their ranking importance. We are investing millions of dollars in teaching the science of better farming; we are seeking the means of better living for the farmer, but to realize the benefits of better farming and better living we must be religious in our efforts to instill in the minds of the American farmers the necessity for and the means of acquiring and applying the principles of better business.

The science of better farming and the plans for better living will not avail unless the foundation—better business—is carefully ingrained in our scheme of agriculture.

Before the days of our excellent transportation facilities each farming community could control its markets and general business by the application of a very simple system—of exchange, sale, and purchase. Since the advent of good transportation facilities no agricultural community in this country is independent of any other section of the country or of the world in general. Prices for our products are fixed by the prices available in the large business centers and our markets are open to invasion by farmers from other sections who can produce our products more cheaply and better in quality.

Better business on the farm reaches into every item of farm life. The layout of the farm with its buildings and fields should be planned as a manufacturing plant is planned—for efficiency. The rotation of crops to be followed should be planned with an eye to definite maximum results; the breeds of live stock to be handled should be chosen on the basis of potential profits; the community spirit, or the association with fellow farmers, should be fostered in a businesslike manner because it is good business; communication with the general business world—or what is generally known as boosting—should be done aggressively by the farmers, for good boosting is good business.

Because our farmers have in the past failed to be good business men there has sprung up in this country a class called middlemen who take it upon themselves to do the business the farmers should do, and these middlemen have year by year taken more and more from the farmer and from the consumer of the farmer's products in return for the unproductive services rendered. Farmers, by combining their resources, should be able to sell well that which they sow and reap.

In the beginning the farmer should realize there are certain farm products for which there is continuous demand in his section of the country and for which he can always receive fair prices. He should join with his neighbors and all should equip themselves to produce those products in quantity and of quality that will insure good returns.

Hundreds of farmers in every section of this country are to-day devoting their time and investments to the production of crops which, though they yield fairly well, do not bring the farmers profits. Farmers should know what crops pay and what crops do not pay. They should apply to their business of farming the methods that are used in successful manufacturing plants—they should keep books with every department of the farm work.

Ascertain what crops or produce pay best in your section and then boost those products and boost your section of the country as the best place on earth for those products. Do not be afraid to make a noise about your products if you have products of the right quality.

The science of successful manufacturing consists of taking raw materials and making them into finished products that are required and desired by the public. Every farm should be a manufacturing plant. Every farmer should market not his raw materials, but a finished product that the public wants. By so doing he will receive the reward for producing the raw materials and the reward for making them into the finished product. The farmer may produce these finished commodities by feeding his grain, forage or root crops to live stock. His manufacturing plant may consist of dairy stock, hogs, sheep, beef cattle or poultry. Or, he may associate with his neighbors and operate a canning factory, an evaporating plant or may organize a creamery and cheese making association.

The idea of making every farm a manufacturing plant is well covered by the maxim, "Raise all you feed and feed all you raise."

When the farmers of this country become better business men you will see them doing better farming and enjoying better living. The business man on the farm will adopt scientific farming methods for business reasons, and he will improve his social condition for business reasons. The most important thing farmers of to-day should strive for is better business on the farm.

THE FARMSTEAD.

PLANNING THE FARMSTEAD.

If each farmer would keep a record of the farm work for a year he would likely find that the number of days actually spent in the work which returns the main farm income is small. During the months from March to November the principal farm work is accomplished and the bulk of the work is usually crowded into about three of these months. Of these three months not every day is a working day, due to bad weather. The result is that the farmer is confronted with the task of squeezing through a maximum of work in short periods, when everything must go as planned or loss occurs. It is in these periods of stress or what our efficiency experts call the "peak load," that a well-planned farmstead and farm are appreciated. Then it is we determine whether every building on the farm is constructed for efficiency; whether each building is located in the right direction or at the right distance from every other building; whether the feed lots, the garden, the poultry yard, and other such subdivisions are properly located and the stock handled to the best advantage. The arrangement of the farmstead is just as important to the farmer as is the arrangement of the factory to the manufacturer. Manufacturers are planning with the view of reducing labor and costs. They are learning to start raw material in one end of a building and bring a finished product out the other end with never a backward movement or a moment's delay in the procedure.

If you are planning new buildings, plan them for efficiency and locate them for efficiency. Plan them just as if every day in the year would be a busy day when every minute of time and every step is valuable.

Planning for efficiency does not mean an unattractive farm layout—rather, an attractive one.

Plan well, for planning takes but a short while and you will use your farmstead constantly for many years.

We hear much talk these days of keeping the boys and girls on the farm, of holding their interest in the farm life. If you are planning a new house, a new barn, a layout of feed lots, a poultry house, or a change in your field boundaries, why not ask your boys to help in

the planning? It may be your boys and girls have been away to school and secured ideas of what is economical, attractive, and convenient in buildings, or in farm planning in general. They may be more consistent than you in reading the farm papers and able to go you one better on some phases of farm planning. Let them help with the planning. Anything that embodies their ideas will be of more interest to them. They will strive to make their ideas successful and they will be slow to leave the farm that they have helped to plan—likewise slow to leave the home where their ideas are appreciated and their contentment encouraged.

FARM PLANNING BY STATES.

Movements have been under way several years in a number of States to promote better farm planning and farmstead building. It is argued that in these times of increased farm income the farmer should invest a good part of the increase in better buildings and

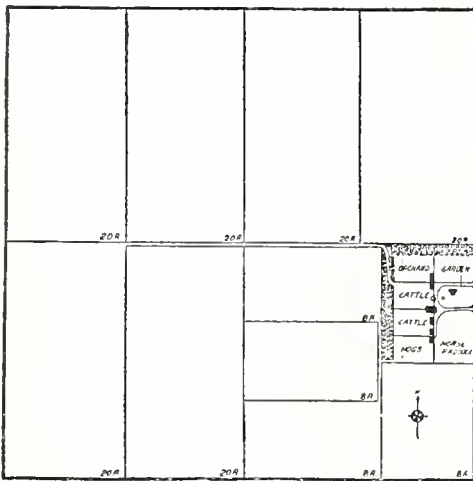


FIG. 1.—A 160-acre farm with farmstead, facing east. Note connection of cattle yard with large fields, and of hog yard with small fields.

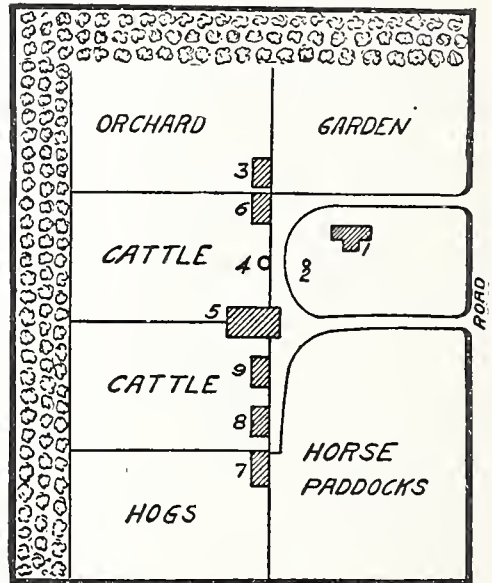


FIG. 2.—Eight-acre farmstead, facing east: 1, house; 2, well; 3, poultry house; 4, watering trough; 5, main barn; 6, machine shed; 7, hog house; 8, corn crib; 9, granary.

modern conveniences, which will increase the value of his labor and the comfort and welfare of the family.

The 1914 Minnesota Farmers' Institute Annual is a farm home number, and in this number is shown a farmstead layout which is worth reproduction and is here given.

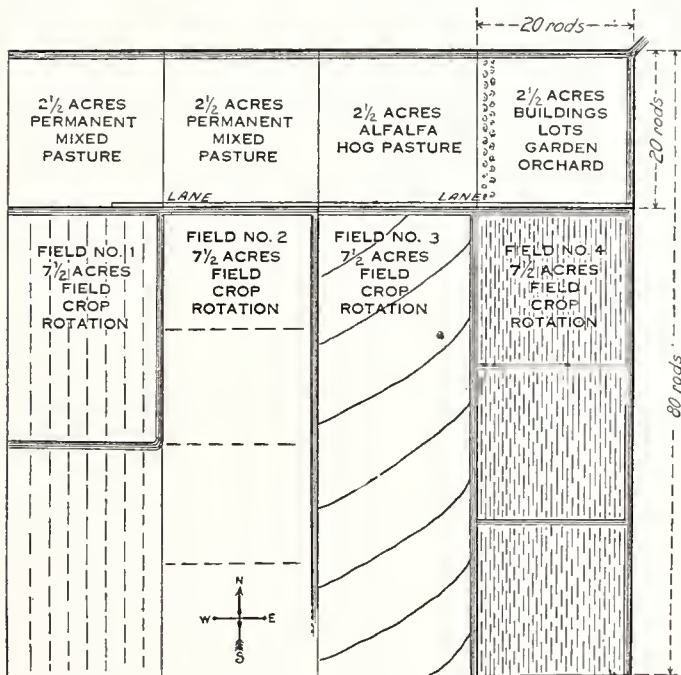
This farmstead utilizes about 8 acres of a 160-acre farm. On our various irrigation projects this plan would need some revision to be suited to conditions, but it shows a convenient, attractive layout, which will give some ideas to those planning new farmsteads or changing existing ones.

FARM LAYOUTS.

There is presented here a suggestion for the layout of a 40-acre irrigated farm, planned to permit diversified farming—crop rotation and live-stock handling.

The plan provides $2\frac{1}{2}$ acres for buildings, lots, gardens, etc.: $2\frac{1}{2}$ acres for alfalfa hog pasture; and two tracts of $2\frac{1}{2}$ acres each for permanent mixed pasture. These small tracts are connected by a lane which in turn connects the four fields which are laid out for crop rotation. These fields may or may not be divided by fences.

The farmstead, or buildings and grounds, is placed in the north-east corner of the farm where the irrigation water is received, this

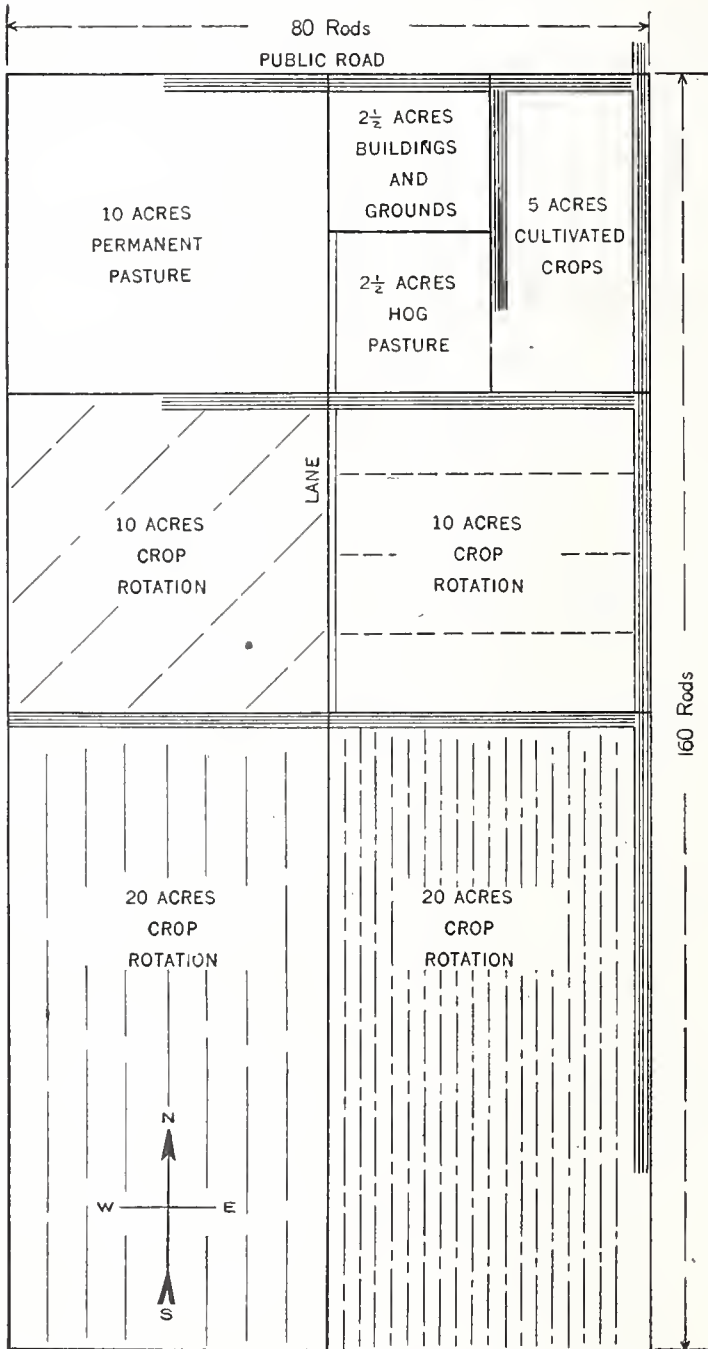


being the high corner of the farm, and the water may be handled with convenience from the farm headquarters.

It is assumed that the slope of this farm is regular and to the south and west. The small pasture tracts should be well leveled and irrigated by the check system. The layout of the farm ditches is shown on the drawing. If the land were well leveled and of a good texture for irrigation, the border system, as shown in field No. 1, could be used to advantage, the borders being from 40 to 50 feet in width. If the land is of a sandy type and a good head of water is available, the check system, as indicated for field No. 2, could be used, using checks of a little less than 2 acres each.

For land of less level character and where the flooding from lateral system of irrigation is followed the lateral system as indicated for field No. 3 is used. These laterals would be spaced from 50 to

150 feet apart, depending upon the character of the soil and the head of water available. For land of coarse texture, where the supply of water is limited, the furrow system, as indicated on field No. 4, should



be used. The length of run to be determined by the head of water and the texture of the soil—on the drawing herewith the run is indicated at 10 rods.

In handling water on this layout the water could be quickly handled to any portion of the farm, and at night the head could be

divided between one or more of the pasture tracts and the particular field crop being irrigated. Some arrangement along the west and south boundaries would be necessary to pick up waste water and prevent damage to the neighbors' fields.

It is recognized that this plan takes advantage of easy conditions, conditions much better than the average water user has to contend with. But it is submitted for the purpose of bringing out suggestions from water users or questions regarding the layout of farms in special cases.

Opposite is a layout for an 80-acre farm where the slope and general conditions favor the farmer in every respect.

The farm is divided to provide two 20-acre fields which may be used for the field crops in a general crop rotation; two 10-acre fields for crop rotation uses; 10 acres for permanent pasture; 5 acres for cultivated crops; $2\frac{1}{2}$ acres for hog pasture; and $2\frac{1}{2}$ acres for buildings and grounds.

The permanent pasture could be further divided into two tracts to permit of continuous use by irrigating one part at a time. The other two 10-acre tracts could be diverted to use for permanent pasture in turn if desired. The 5-acre tract could be used permanently if desired for the production of crops to be harvested by hogs or sheep. The length of farm lane necessary to connect up all these fields is small and no great distance is traveled in reaching any field on the farm.

The irrigation water is shown as entering the field at the northeast corner and the slope is south and west. It would be necessary to run a small farm ditch across the north end of the farm to provide irrigation for the east 20 acres. The main farm ditch would extend down the east side of the farm and carry water for the 60 acres in the four larger fields.

IMPROVING THE FARM.

DIVERSIFIED FARMING.

The farmer on irrigated lands should, where possible, practice a system of diversified farming. Diversified farming naturally follows irrigation. In humid regions you have to grow crops to conform to the rainfall, while by irrigation you can conform your moisture to the crops. Irrigation is naturally more expensive. Lands cost more, maintenance and operation charges have to be met, besides the cost of distributing the water on the land.

For these reasons the farmer should take advantage of the many benefits that arise on the irrigated farm. He can grow crops from early spring until late fall. He can plan for early crops, midsummer crops and late fall crops, as he has the moisture at his control. Some crops need and do better with a great amount of moisture, and others require very little. In a great many cases the farmer can grow one, two and three crops on the same land in one season. He can, after an early crop of alfalfa or clover, grow a crop of seed, or after a crop of early wheat or oats, he can irrigate and grow a splendid crop of pasture for fall at light expense. He can sow rape in small grain in the spring, or in corn at last cultivation and have splendid sheep and hog pasture for fall. He can, to good advantage, irrigate after harvesting early grain for fall plowing and sow rye for fall and spring pasture, and still have a green crop to plow under in the spring for fertilizer.

By having diversified crops he will not need to irrigate his place all at one time. By late fall irrigation he can save one irrigation the following season. Early vegetables can be followed by late garden stuff. Celery will do well following early potatoes. Early grains can be harvested so as to sow fall wheat on the same ground. Some crop can and should be grown in the orchard, especially the young orchard. Late fall irrigation is good for the orchard in the North, and winter irrigation is recommended in the South. More trees are killed by droughts in the winter in eastern Montana than in summer.

No farm large or small has a complete system of diversified farming without some stock—cattle, sheep, hogs or poultry—and the kind should be governed by local conditions, market, etc. In fact, the whole diversified system can be planned to fit the whims or likes of the man on the land. It is an old saying that fun is work that you like. So why not plan your farm work so as to have some fun?

THOROUGH CULTIVATION.

The most important part of better farming is better preparation of the soil. All the other essentials of good farming fall down if the matter of thorough cultivation or preparation of the soil is neglected. Thorough cultivation will sometimes produce a crop for the farmer even though he has insufficient moisture and a poor season.

Now, the question is, what is thorough cultivation. Thorough cultivation begins with good plowing. Then follows the question, what is good plowing. Plowing, though seemingly a simple matter, is the most important operation in the tillage of the soil. Upon it to a great degree depend the nature of the later operations and the frequency and extent to which they will be required. In fact, unless the soil is plowed in the best manner possible, and at the right time, the preparation of the land for growing a crop will require additional labor and cost. It may even be impossible to prepare a good seed-bed when plowing is done under adverse conditions.

It has been demonstrated in several States by a series of experiments, especially in old ground, that deep plowing gives better results than shallow plowing; that soil plowed seven to eight inches deep will average 25 to 35 per cent better crops than soil plowed four or five inches deep.

Plowing should be done in nice, straight, and even furrows, with the stubble or whatever aftermath there is on the surface well turned under, so that it will not come to the top of the ground when worked with harrow or disk.

Back furrows should be turned out, then plowed back, so that there is not three or four feet in width of land under the back furrow which has not been plowed. Also, after making the dead furrow there should be a couple of light furrows turned back so as not to leave a deep dead furrow.

If two plows are being used see that they both turn the same kind of a furrow; it will save labor in leveling.

In spring plowing it is important that the plow be followed at once with some implement—harrow, disk, roller, or planker. In this way you can conserve moisture and at the same time the ground will work up better than at any time later.

If possible, spring plowing should be disked before plowing. It will hold your soil in nice shape for plowing much longer than if not done, and what is more important, it will have worked the part of the furrow that most needs working—that is, the bottom part.

The general impression is that it is the top two or three inches of the seed bed that should be in good shape, while in fact it is the bottom two or three inches of the seed bed that must be well worked and in good shape.

Any good cultivation requires at least one double disking, and in most cases two double diskings are better; then at least one double harrowing; then the leveler; and again the harrow followed by the planker or roller.

The leveler should be run crosswise of the plowing so as to fill dead furrows and take sown back furrows. Generally each implement should be run crosswise or diagonally to the previous working.

The field should be left about one week to permit settlement of the soil before seeding. In case a rain should occur during this time the harrow should be used again.

It is well, in case the soil is fairly loose, to run the roller just ahead of the drill as well as just after it. There are times when it is well to roll just as the grain is coming up, especially if the soil is inclined to crust or in case there has been a rain.

It is not practicable to state in a general article just what any one farmer should do with his own particular soil. The above is a fair outline under favorable conditions. Under adverse conditions thorough cultivation may mean as much as double the work outlined to secure satisfactory results.

In closing, have in mind that the bottom of the furrow is the important part. To put the bottom part of the furrow in good shape is the reason for the major portion of the work described in the foregoing.

FALL PLOWING.

Fall plowing has advantages which should not be overlooked these days of high prices and scarcity of labor.

Heavy soils for spring seeding should always be fall plowed. Such soil may be plowed more deeply in the fall than is safe in the spring; also it may be plowed when more wet or more dry than is permissible in the spring.

Trash turned under in the fall has time to rot during the winter; trash turned under in the spring may not rot and, if it does not, will seriously interfere with the movement of water in the soil and with the root development of the crop.

Soil turned up in the fall and left rough during the winter will catch and hold winter moisture. As a rule, fall plowing, through the holding of winter moisture, requires one irrigation less than does land which is spring plowed. This is an important item when labor is scarce and water is bought by the acre-foot.

Soil left rough in the fall will be firmed down during the winter and pulverized by frost action to the extent that much less work is required to put it into shape for seeding in the spring than is the case with spring plowing. Oftentimes a single harrowing will put fall plowing in shape for seeding; with spring plowing three to five operations are necessary. Winter weather on plowed soil will do from \$2 to \$5 worth of work per acre for the farmer.

Plowing and fitting soil is the hardest work farm horses have to do. Spring plowing comes at a time when the horses are soft from winter idleness and is responsible for many of the ills that horse-flesh is heir to. Fall plowing comes at a time when the horses are hardened from the summer's work and when the work may be done more leisurely than in the springtime.

Seed will germinate more quickly and evenly on fall plowing than on spring plowing. It is particularly important on irrigated land that the seed germinate evenly and the entire seeding grow evenly; irrigations may then be timed to good advantage.

The one important disadvantage to fall plowing is that considerable roughage which might be used for stock feed may be turned under. If a farmer has live stock sufficient to utilize every item of roughage on his farm he may seriously debate turning under roughage early in the fall. In the main, however, the advantage in this connection lies with fall plowing, as the gain in production through fall plowing will more than offset the loss of the roughage plowed under.

BUSINESS ON THE FARM.

Now that it is generally understood that the farmer is taking to up-to-the-minute business methods in his farm work it would be interesting to know just what percentage of our farmers have the first requisite of business on the farm, namely, a business office.

Business methods will have a short shrift on the farm where the farmer carries his records in his mind or a vest-pocket book or in a corner of the kitchen cupboard. Some place about the house there should be a corner, nook, or room that can be given over entirely to the farm's business.

It is not necessary or desirable to put into this all the flubdubs in the way of office fixtures. There should be a table or a desk where the work may be done accurately and conveniently. If it is possible

to have a roll-top, with pigeonholes and drawers, so much the better, for then the records may be safely stowed away in good order.

Next in order comes a filing system of some kind. This may be a homemade box divided alphabetically by heavy cardboard guides, or it may be the small indexed letter file which is commonly sold at stationery stores for about 50 cents. This file is important, for it provides for the orderly keeping of letters received and copies of letters sent and makes the finding of such letters easy.

Typewritten letters from farmers are becoming more common. A good second-hand typewriter may be secured for from \$20 to \$50. A typewritten letter gives the impression that the farmer is up to date and simplifies the making of copies of letters through the use of carbon paper. Copies should be kept of all important letters and all contracts, agreements, and other important papers signed by the farmer, and these should be carefully filed away where they may be found readily.

Then there should be the farmer's scrapbook, into which should be placed all the hints and helps which are to be found in all the agricultural papers and periodicals.

Last but not least is the bookcase. Every farmer acquires books and pamphlets pertaining to his business, and these should be kept convenient for ready reference. The bookcase need not be the expensive sectional affair. Make your own bookcase, to fit into the space available for it and of the size that meets your requirements.

The old saying, "Black a man's boots and you keep him out of the mud," is pertinent in this connection. Give a man business tools and you keep him out of unbusinesslike practices.

TREES.

One of the principal criticisms we still hear about our irrigation projects and the West in general is that there is a lack of trees. People coming from the East or the Central States, where trees are plentiful and of great variety, find something lacking in the West and that something is trees.

People living in well-wooded sections or the farmers who have good wood lots should feel thankful for their good fortune these days when we read of the great suffering in eastern cities because of lack of coal for fuel.

There are several reasons why the people in Western States have not heretofore started more trees, the principal reason being that the growing of trees in semiarid sections requires considerable care and heretofore our farmers have been busy with the necessities of homesteading.

There is no reason why our projects should not now see a general movement in the way of tree planting. Trees may be selected for several purposes. If shade alone is the consideration, some of the quick-growing varieties of shade trees may be selected. If beauty, shade, and profit combined are desired, a wide range for selection is found in the fruit and nut trees. It should be borne in mind, however, that these trees require much more care than trees grown for shade only.

In some sections of this country and in several of the European countries it is quite common to see the roadsides lined with fruit trees, which make a most attractive sight at blossoming time and give much comfort and profit as the fruits ripen. The custom of bordering lanes and fence lines with fruit or nut trees is becoming more common.

The value of shade to live stock is never overlooked by the wise stockman. Brood mares, cows, sows, and ewes particularly require shade while rearing their young, and good shade to which they can retire from the sun-stricken and insect-infested pastures during the heat of the day saves many dollars on the feed bill.

Planting trees closer together than the permanent stand should be permits thinning them out as they reach the size where they are inclined to crowding, and the trees cut out may be utilized for fuel or posts or for other purposes. This is the best method of insuring a good stand, as it is easier to thin the trees out to a good stand than it is to put in new trees to make up a stand.

In some European countries numbers of towns have had town forests, large tracts of land near the towns being owned by the towns, and the returns in the way of fuel and materials from these forests often paid all the running expenses of the towns so that no taxes were levied. It is not likely that this plan will soon be tried out by American towns, but it shows the practical value of trees.

Individuality in the selection of trees and the arrangement of them in planting is desirable, but it is believed that the general improvement of a community can be best advanced if a limited number of varieties be planted and the choice be confined to the varieties known to do well in the locality. Some trees, the cottonwood notably, have been found unsatisfactory for town planting, because of the roots growing into and filling sewer lines and the nuisance caused by the cotton given off by the trees. Some towns have enacted ordinances prohibiting the planting of such trees.

In a matter of this kind a community can afford to wait a little time for the maturing of trees which, though more slow of growth, are more satisfactory and longer lived. In some cases it has been found practical to plant alternately a slow-growing and a fast-

growing tree and as the slow-growing trees reach sufficient size to furnish shade and beauty, the quick-growing trees are cut out.

It is unnecessary to point out all the advantages of tree planting. Most people realize these advantages, but just naturally postpone planting the trees. Every one of our projects should have an arbor day, to be recognized by the entire project each year, when it would be the custom to set out trees and shrubs of a permanent nature.

FENCES.

One of the unfortunate things which can happen to a farming community is that of acquiring a habit of building poor fences or of putting into effect laws which tend to make good fences unnecessary. A good fence is the best crop insurance a farmer can buy. It is poor business policy which leads a man to pay a high annual premium for hail or tornado insurance and then half-heartedly build a patch-work fence which will not turn his own or his neighbor's stock. You can not farm to advantage without live stock, and you can not keep live stock without good fences. If your neighbor will not join you in building a stock-proof fence on the line between farms it would be cheaper for you to build the entire fence; then you can handle live stock on all your fields, utilize all the feed you grow, and you will not have to lie awake nights wondering whether your stock is in your neighbor's fields or whether your neighbor's may be ruining your crops. I believe more neighborhood quarrels have started from poor fences than from any other cause. There is no limit to the trouble brought about by poor fences. The following is quoted from an old almanac and is as true to-day as when written generations ago:

He that is careless and negligent about his fences will be so in most other things. His life is a state of continued vexation, trouble, and irritation. How often he finds his crops destroyed, his breachy and unruly cattle impounded, with complaints of his injured neighbors perpetually ringing in his ears. He is hurried into lawsuits and unnecessary expense; and sees the Sabeans hunt his flocks and the Chaldeans trespass upon his inclosures! Alas, he has no peace of mind; how vexed, disquieted, tormented for the want of fences.

CARE OF FARM DITCHES.

How about the farm irrigation and drain ditches? No doubt the irrigation season just passed has found some faults in the layout, capacity, or efficiency of the ditches. Now is a good time to correct some of these faults.

It is likely that one of the most serious drawbacks has been the presence of weeds in the ditches, hindering the flow of water and causing it to overflow low banks. More than likely these same ditches are now a mass of ripened weeds, depositing their seeds for a still

more lusty growth next season. Gather up these weeds, with as little scattering of seeds as possible, and burn them. Make the piles for burning on spots where the most obnoxious weeds grow in order that their seeds will not be scattered and may be burned most effectively.

Go over the ditches and, as far as is practicable at this time, remedy the weak spots. Build up low banks so the dirt will settle well before next irrigation season. Put in new or replace old checks where needed; remove the silt from the bottom of ditches and use it to fill borrow pits or low places near by. Don't make the mistake of building the banks higher at points where the ditches collect silt; you are making future trouble if you do. Keep the ditches cleaned out to the proper grade.

The most important part of the irrigation work is done outside of the time you are actually irrigating. Removing obstacles to easy handling of water and having everything possible in full readiness makes for quicker, better, and cheaper irrigation. If you have a little time just before winter sets in, do some work on your ditches.

FIRE PROTECTION ON THE FARM.

If you live in the city, you spend a considerable amount of money each year for fire protection. Your property tax covers your portion of the amount necessary to maintain the city fire department. If you live in the country, you probably spend little or nothing for fire protection, though your risks are considerable. True, most farmers have their buildings and contents insured against loss by fire, but not many farmers care to see their property go up in smoke for the amount of their insurance policies.

Not only would a few simple precautions against loss by fire reduce the probability of fires, but the rates paid for insurance would be accordingly reduced. Fire insurance companies are quick to take advantage of lack of fire-protection facilities and to charge high rates for protection under such conditions; also, they are reasonably quick to give credit, in the way of low rates, where the property owner provides some protection.

Of course the best protection against fire is water under pressure and piped to all buildings. This may be provided by elevated tanks with suitable pipes, or by power from an engine applied to a force pump. Climatic conditions will largely govern a choice between these two methods; where extreme cold weather occurs it may not be safe to put too much dependence on elevated tanks and a complex system of pipes. A force pump to be operated by hand and to which a hose may be attached will furnish protection to buildings close at hand.

The objection to putting dependence on this outfit is that it is a "men only" proposition, and fires sometimes occur when the men folks are away from home.

There are on the market a number of patented fire extinguishers, which may be carried by one person without much trouble. These extinguishers work on the chemical principle, and some of them do very satisfactory work; one or more of the best makes would be a good investment for a farmer.

Every farm should have ready for instant use light and long ladders at both house and barns. A few fire-protection buckets, to be used only in case of fire, should be at both house and barns. Railroads, lumber companies, and similar business concerns keep barrels filled with water at convenient places for use in case of fires.

Lightning rods play an important part in fire protection in sections where lightning is frequent. Do not let the old-time jokes about lightning-rod agents convince you that these rods have no utility. Fire insurance companies look at fire protection in a very practical way and the fact that they give better rates on houses protected by proper rods than on houses not so protected is some argument in favor of good lightning rods.

Do not overlook the fire risk. Spend a few dollars to assist in making the lives of your family, your live stock, and your valuable property more secure.

WINTER WATER FOR STOCK AND DOMESTIC USES.

Every fall there come up the question and agitation for running water in the canals for stock and domestic uses after the close of the irrigation season. Securing the necessary water for these purposes is quite a serious problem on many of the projects. It appears to me, however, that the running of water in the canals for stock and domestic uses is the worst possible solution of this problem.

It is now recognized that one of the most important difficulties in connection with irrigation is the seeping and water logging of the irrigated lands. The costs of draining water-logged lands have mounted up until we must admit drainage is a serious matter, and that we should avail of every means of removing the causes of drainage. I believe the major portion of the water logging of lands is due to loss of water from canals and laterals. Experiments have shown conclusively that on some of the projects the loss of water in the canals amounts to from 15 to 50 per cent of the total taken into the head of the main canals. It is not necessary to go into details in this connection; we all know that the escape of this high percentage of water from the canals creates a serious drainage problem.

One of the most practical means of preventing the water logging of the land is to reduce the period of time during which water is run in the canals. If water for stock and domestic uses is run in the canals both before and after the regular irrigation season it is quite likely that the period of keeping water in the irrigation system is practically doubled. This means that the drainage burden is more than doubled, for whereas the soil can handle a reasonable amount of excess water every increase in this excess water multiplies the drainage problem manyfold. In Montana and other sections where similar conditions prevail, where the average annual rainfall is as much as 15 inches, it would be practicable to confine the irrigation season to about three months, or from about May 15 to August 15. This would mean a reduction of about one-third in the irrigation season, which would work a similar reduction in operation expenses and in wear and tear on the irrigation system. It would also mean less expenditures for drainage. The average cost of drainage on the projects is running as high as \$10 per acre. A small portion of this drainage expense would put a good reservoir, cistern, or well on every farm under the projects.

In order to reduce the period of operating the canals, it would be necessary to provide means of furnishing water for stock and domestic uses on some of the projects for at least half of the year. There are three practical means of supplying this water—storage reservoirs, cisterns, or wells.

It is quite common to find ponds with earth embankments constructed on the lower portions of farms on a number of the projects. These ponds are very objectionable from both a sanitary and economic standpoint. The water becomes filthy and is made the breeding place for insect pests, and the water held in these ponds creates seepage on lands lower in elevation.

I visited a farm on the Uncompahgre project in Colorado where the farmer had constructed a concrete-lined reservoir with a sloping end where the stock could reach the water. It was filled by gravity from the irrigation canal and the owner was enthusiastic about it. The concrete-lined reservoir is a great improvement over the ordinary pond. The disadvantage of an open reservoir is that ice forms on it during winter in the central and northern portions of the country, making it difficult for the stock to reach the water, to say nothing of the disadvantage, from a stock feeder's standpoint, of giving stock ice-cold water. However, if a reservoir is the best water supply you can secure, line it with concrete and provide an outlet so you can clean it out occasionally. A reservoir, concrete lined, to hold 600 to 800 barrels of water should be constructed for not more than \$200, the farmer performing most of the labor. This reservoir filled should

supply water for 50 sheep or hogs, 10 horses, and 20 cattle for about 4 months.

A good cistern is better than an open reservoir. It is more expensive to construct, but it has the important advantage of furnishing water free from ice. The difference in favor of clean well or cistern water as against muddy or ice-cold water from a pond where as many as 100 head of stock are kept would pay for a good large cistern in one year. A cistern of about 100 barrels capacity should be constructed for about \$100, the farmer performing most or all of the labor. Cisterns to suit the varying requirements of the farmers will, of course, vary in cost with the sizes constructed, the cost of materials and the nature of the excavation made. The labor is by far the most important factor and this the farmer can usually do himself.

Wherever it is possible to get good well water the farmer is justified in going to considerable expense to secure it. On some projects the farmers are tapping the drainage ditches and securing fair stock water. On other projects where alkali is bothersome pipes or jointed tile are put down in a well which extends to below the alkali. On my farm I have several wells where I have driven pipe down about 40 feet at a cost of \$1 per foot, and I secure excellent water.

By some method we can on each project avoid the running of water after the irrigation season for stock uses. We should by all means do this for the reasons I have stated.

The engineers of the service will, I am sure, be glad to help settlers with designs or estimates for reservoirs or cisterns.

BURNING STRAW STACKS.

Every little while something happens to bring home the truth of the old song "We never miss the water till the well goes dry." While I think I have been as appreciative of plenty of good straw to use around the barns and yards as the average farmer, I confess I have never taken the trouble to figure out just what the value of straw is until very recently. A 20-ton straw stack was accidentally burned on Hesper Farm last fall and I have missed this straw very much. Burning straw on Hesper Farm is something out of the ordinary, and it has led me to compute the loss to the farm.

The 20 tons of straw used through the barn or feed yards would have accumulated to 40 tons of manure in the spring. Forty tons of manure would fertilize 4 acres of land. A reasonable estimate of the increase in crops the first two years due to this fertilizing would be the equivalent of 3 tons of sugar beets per acre. Beets are worth a minimum of \$6 per ton, which means that the loss of the straw stack is equivalent to a loss of \$72 in crops.

This does not take into consideration the loss of comfort to live stock in case plenty of bedding is not available for the stables and for putting over wet places in feed yards.

I am more then ever convinced that burning straw stacks is an expensive pastime.

SAVE MORE.

The idea uppermost in the minds of the farmers and those having to do with farming in this country may be expressed by the phrase "grow more." The agricultural papers, the agricultural teachers, and those perpetual advisers of the farmer—the bankers—are spreading the gospel of "grow more" in a way that gladdens the hearts of the concoctors of commercial fertilizers. It is true that the man who makes two blades of grass grow where one grew before is a public benefactor and the ambition to increase the rate of production on our farms is a commendable ambition. But growing more is not a panacea which alone will cure all the farmers' troubles. It is admitted that increased production is the basis of prosperity on the farm, but coupled with the idea of "grow more" should be the principle of "save more."

It is not always the farmer who produces the heaviest crop yields per acre and who keeps the largest numbers of live stock who is the most prosperous farmer. We all know men who produce but ordinary crop yields and keep but a small number of farm animals, yet they prosper—they live well and not in a hurry. The principal difference between these two types is that one is a producer only while the other has mastered something of the art of saving. The secret, which is not a secret, of continuous prosperity on the farm is "save more."

The significance of the phrase "save more" should not be restricted to the miserly hoarding of money. "Save more" properly includes the planning of the farm work and business to the end that the best possible use is made of the labor, equipment, and produce of the farm. The principle of "save more" may in part be stated by "don't's":

Don't try to farm 160 acres when you can better farm 80 acres.

Don't sacrifice quality for quantity in crops or live stock.

Don't feed good quality feed to poor quality live stock.

Don't feed high-priced feed to live stock and then leave the live stock unsheltered in all kinds of weather.

Don't hire help to raise crops that don't pay for the raising.

Don't hire help and then fail to furnish the help with suitable tools and implements with which to earn wages.

Don't buy good tools and implements and then fail to properly care for and shelter them.

This list of "don'ts" might be added to until it be doubled many times, and yet the principle of "save more" would not be entirely expounded.

I have read of a club or association of farmers which was called the "No Wasters." The idea of this club was to prevent waste of all kinds on the farms of the members of the club. The farm of each member was visited by the club and causes of waste pointed out and remedies suggested. Think of what could be accomplished by such an organization, and there is need for just such an organization in each farming community.

By all means try to "grow more." Don't be satisfied with ordinary yields, but remember that net results are what count, and to make the net result for each year right you must continuously and vigorously "save more."

Who Cares for Dry Pastures?



FARM IMPLEMENTS.

THE DISK.

Ordinarily I would begin with the plow, for plowing is generally understood to be the first important operation in preparation of the fields for seeding. I am, however, starting with the disk, for the reason that the use of this implement on the irrigated farm—on any farm—is very important as a preparatory step to plowing.

For irrigation farming it is important that the soil be handled in such a manner that it will be kept in a physical condition favorable to use by plants of the moisture in the soil. When plowing time comes on the irrigated farm the soil dries out on top very rapidly unless preventive measures be taken. If the plowing is started when the soil is just right, it is likely to be breaking up in a cloddy condition before the field is finished, leaving air spaces where a good, compact seed bed should be. Double disking the ground ahead of the plowing will thoroughly pulverize the surface and effectively prevent drying out of the soil; also, this pulverized surface is turned by the plow into the bottom of the furrow, making a perfect contact between the bottom of the furrow and soil turned by the plow. While this disking ahead of the plow appears to be extra work, it is really labor saved, as much less work is required to bring the plowed ground into good condition for seeding, and the farmer may be positive that the all-important seed and root bed is in first-class condition.

A similar use of the disk following the grain binder prepares the ground for fall plowing, retaining the moisture in the soil until the grain is removed for threshing and opportunity given for plowing.

Following the plow the disk may be used to good advantage in two ways. Set at an angle it will pulverize the surface, and followed by the harrow prepares a good top to the seed bed. Set to run straight or nearly so it acts as a packer to settle freshly plowed ground which is soon to be seeded.

The disk is also a labor saver in putting in crops on land that has been in cultivated crops the year before. Here the farmer gets the advantage of crop rotation. By going from a cultivated crop to a small grain crop he is enabled to prepare the land in the spring with

the disk for seeding, which is a quick and easy operation as compared with the plow.

If stubble ground is not to be fall plowed it should at least be gone over with the disk, turning under the scattered grain and weed seed which will be sprouted by fall rains and later winter killed. Otherwise these seed would volunteer in the next year's crop and cause trouble.

As outlined, the disk has its uses but it should not be substituted for the plow. It is a surface worker and does fine execution both before and after the plow. Where it is necessary to turn the soil to a considerable depth the plow must be used.

Cross disking does not give as satisfactory results as double disking or lapping the disk one-half its width.

A number of companies manufacture disks for which they make various claims. All disks work on the same principle. An important item is the size of the disk. This implement operates with a combined cutting and revolving motion and the smaller in diameter the disk the more efficient it is in pulverizing the soil. From this it may be judged that preference should be given to the smaller disk. A 14-inch diameter gives good all-around service. The width of the disk will depend upon the amount of horsepower available. As this implement is worked at a time when speed is important it is well to get the widest size consistent with the available horsepower.

Keep the disk sharp; it is impossible to get good work out of this implement when it is dull.

PLOWING AND PLOWS.

Plowing is the first important step in soil culture. As just described, a very advantageous preparation for plowing may be made by double disking ahead of the plow to hold the soil in moist condition and insure the "fining" of the soil turned into the bottom of the furrow by the plow.

As understood by most people, plowing the soil is done for the purpose of putting it into a condition favorable to plant growth. The loosening and mixing of the soil assist the proper action of the air and moisture in the soil and encourage the working of the plant-sustaining elements. If such conditions are to be brought about, it should be understood that unless plowing be done at the right time—or when the condition of the soil is right—no advantage is gained and much harm may be done.

Various types of plows are on the market, each designed for some special condition or type of soil, and while these various kinds of plows may be used to advantage under varying conditions encountered, it is more important to plow when the soil is right for plowing

than it is to pick out just the proper kind of plow to use. No kind of plow will leave wet land in good condition and no plow will bring hard, dry soil into good condition.

A great deal of poor advice is current regarding the proper depth to plow. The old maxim of "Plow deep while sluggards sleep" is considered by some with the same enthusiasm that led a man to take an entire bottle of medicine at one dose on the theory that if a little is good more is better. A great deal of agitation for deep plowing exists without proper regard for the varying conditions of soils. Without doubt deep plowing has its great advantages under certain conditions and should be practiced. It is just as certain that there are conditions under which deep plowing is a serious mistake. Soils inclined to be light or sandy and containing plenty of humus may be plowed deeply with good results continuously. Heavy or clayey soils may be plowed deeply with good results if the farmer is willing to do the work necessary to bring deeply plowed heavy soils into good condition, which is not a light task. In some sections of heavy soil it is the custom to plow deeply, thoroughly work the surface of the plowed ground, and then plow again and work the surface again. The amount of humus or vegetable matter in the soil should to a great degree regulate the depth of plowing. Soil that contains no humus should not be brought to the surface in great amounts at any one plowing.

Straight, clean furrows of even depth are very important items in good plowing. Crooked furrows make an irregular surface of the plowed ground, and where one furrow is deep and the next is shallow it is practically impossible to work the soil down to a good seed bed, as the hard surface in the bottom of the shallow furrow will prevent the drag, harrow, or disk from working down the soil in the bottom of the deep furrow adjoining.

With the irrigation farmer it is important that the surface of fields be kept level, and in plowing no pronounced "back furrows" or "dead furrows" should be left to interfere with the handling of irrigation water. The two-way plow is a convenience in this connection, as plowing may be started on one side of a field and continued across the field without "back furrows" or "dead furrows." If the two-way plow is not used it will be necessary to leave irregularities where "lands" are started and finished, but these may be minimized if care is taken. In starting "lands" the "back furrow" should first be turned out and then turned back so that no unplowed strip will be left in the middle of each "land."

To secure good results plows must be properly adjusted. The large companies manufacturing plows keep in their employ experts who have made special study of the adjustment and working of plows. It would not take one of those experts long to convince the

average farmer that it takes some "know how" to adjust a plow to get the best results. When you buy a plow get the implement dealer to tell you all he knows about adjusting the plow to meet your conditions. On the proper adjustment of the plow depends the amount of horsepower necessary to pull the plow, and also the grade of work is much affected.

The implement dealer in your locality can give you the best advice on the kind of plow to buy for handling your soils. Being a local man he is acquainted with local soil conditions, and it is up to him to sell you a plow that will work to your satisfaction.

AFTER PLOWING—FITTING THE LAND—THE LEVEL OR FLOAT.

If plowing is always done under ideal conditions, the work of fitting the land for seeding and irrigation is a simple matter. With our wide variations in soil and climatic conditions it is not possible to plow just when we would or to have the soil in just the right condition. Under any condition, the first step after plowing is to give the land either a single or a double harrowing as the condition of the soil requires; this breaks up the chunks of soil and prepares a mulch which prevents the plowed and loose soil from drying out. The more quickly the harrow follows the plow the better are the results.

Very few fields in irrigated sections are in the best possible condition for irrigating. While the surface may appear level and regular to the eye, we all know from experience that the irrigation water will find high and low spots which will give trouble in distributing the water. If very prominent high or low spots exist the only cure is to cut off the high spots and carry the dirt to low places. A good tool for this work is the fresno scraper.

For general leveling purposes the farm level or float is the most practical device. It is not intended to cut off high knolls or fill up deep holes, but following the use of the fresno scraper or following the harrow or disk on fairly level land it does fine work and is a labor saver.

This level or float is made 16 or 18 feet in length and in width to suit the horsepower the farmer has available. A level 8 feet wide works well and makes a good load for 4 horses. One 4 feet wide may be handled with 2 horses, but the work is not so satisfactory as may be secured with the level of greater width.

The level consists of 2 planks 2 by 10 inches, 16 or 18 feet long, set on edge like sled runners, with 3, 4, or 5 crosspieces of 2 by 10 inch plank also set on edge to act as cutters. The bottom edge of the crosspieces should be flush with the bottom of the runners. The crosspiece placed across the front end of the level should slant forward a little at the top to prevent it digging in too much. The rear

crosspiece should be upright. There are differences of opinion as to whether there should be 1, 2, or 3 crosspieces ranged in the middle of the level to act as cutters. Some irrigators put in as many as three, spaced 2 to 3 feet apart. Personally, I favor a single crosspiece in the center of the level, on the theory that if the weight of the level is placed on a single bearing surface or cutter, that cutter will be more efficient than if the weight is distributed to several cutters. The center crosspieces should have a steel edge to prevent their wearing away. The level should be well braced and supplied with a plank down the center on which the driver can walk back or forward to assist the level in loading or unloading.

After the land has been plowed and harrowed, the level should be run first at right angles to the direction of plowing and then in the direction of plowing. Good results are also secured by running the level diagonally across the field.

It should be borne in mind that all the work done in leveling an irrigated field means labor saved and increased crop yields. Every low spot means just that much land which will be overirrigated. Every high spot means just that much land not sufficiently irrigated. Also, we all know the difference in labor between irrigating level land and uneven land.

If, after going over the land once in each direction with the level, the surface of the field is still irregular, the land should be harrowed again to loosen up the surface and the operation with the level repeated. The surface of the ground must be loose or the level will not do good work.

A farm level or float is a device every farmer should be able to make. The materials are not expensive. It will give years of service, and every operation with it will give good returns. If you can not have one of your own, cooperate with a neighbor and own one in partnership with him.

THE HARROW.

If the maxim, "Old age is honorable," holds good with farm implements as well as with men, then the harrow is by right honorable indeed. Centuries ago the worth of the harrow as a help in preparing land for seeding was recognized, even though the harrow of antiquity was nothing more than a thorny brush which was dragged many times over the broken ground. Changes affecting the harrow have been in the form of the harrow only; the theories of its use have remained the same. One of the early improvements in the harrow was that of fastening two small trees or brushes together by a crosspiece at their butts and in this crosspiece were placed wooden pegs which stirred the soil as the harrow was dragged across the field.

Following this there was the wooden frame with wooden pegs, made in much the same shape as the modern single-section harrow—though, of course, much more cumbersome. Then the wooden pegs were replaced by iron pegs which stood the wear better, and later the form of the harrow was changed to resemble the letter A, and this A harrow was used for many generations and well into the memory of many of us of to-day. As our prairie lands were brought under cultivation the demand for a harrow which would permit covering more ground per day resulted in the sectional harrow—made first with wooden frame and steel teeth and later with steel frame and teeth and equipped with levers by which the slant of the teeth and their penetration could be regulated.

Like all farm implements, the harrow has its uses and abuses. If harrowing is done at the right time and with the proper soil conditions the results are highly profitable, but harrowing at the wrong time or with improper soil conditions would better be left undone. When the soil is just right for harrowing every effort should be made to hurry the work. The great amount of ground which may be covered by the modern harrow suits it well to what is expected of it. If ground is harrowed when too wet the same damage as plowing wet ground results. The soil is in part “puddled” and its condition to help plant growth destroyed. Likewise, there is a condition of dryness of the soil when it is lost labor to harrow. Working up a very fine, dusty, and drifting top soil is not an aid to moisture retention, but aids the drying out of the soil. If soil is plowed in right condition, following the plow as quickly as possible by the harrow is very beneficial. Also the use of this implement following rains to break up crust formation and maintain the soil mulch gives good results. A light harrowing at the time such crops as corn, potatoes, beets, grain, etc., are coming through the soil surface serves the double purpose of aiding an even crop stand and destroying weeds that are at the proper stage of growth for destruction by the harrow. The harrowing of such crops, however, should not be done very early of mornings or at times when the plants are crisp and easily broken by harrow teeth. On the other hand, when harrowing plowed ground to kill young weed growth, try to pick out days that are cloudy or utilize the early mornings, as the weeds will be more effectively damaged.

The theory of the use of the harrow is to stir rather than turn the soil. This stirring is particularly beneficial in that it introduces air into the soil, thereby warming it and encouraging the action of the plant-promoting agents in the soil.

Meadows, pastures, and hay fields become “hidebound,” a condition which is relieved by timely use of the harrow, preferably in the

spring just when the growth is starting. Of course, special implements for this work are manufactured, but in the absence of such special implements, you can get results from the peg-tooth harrow, the spring-tooth harrow, or the disk.

The harrow as now constructed is so arranged that if properly hitched the teeth will not follow each other or "track." If the teeth do "track" change the hitch, as you are not really harrowing unless each tooth stirs its own particular strip of soil.

Do not be discouraged if your field looks worse after harrowing than it did before the work. The harrow has a way of dragging clods to the surface and of letting the fine soil down to the seed bed proper where it is needed. A clod on top of the ground is far less dangerous than one a few inches under the surface.

The great advantage of the harrow lies in the simplicity of its construction and use. If you can not afford to buy a modern steel harrow you can follow the example of your forefathers and make an A harrow which will do good work and last for years.

CULTIVATORS.

The cultivator is an implement which is, I regret, too little appreciated and too sparingly used on many irrigated farms. Unfortunately many of our farmers have acquired a belief that irrigation gives the same, or as good, results as cultivation. This is, I assume, based on an understanding that the principal reason for cultivation is the retention of moisture in the soil, and it is reasoned that it is more simple to provide more moisture by irrigation than it is to save moisture by cultivation. The retention of soil moisture is one of the principal functions of cultivation, but there are other reasons which must not be lost sight of. The plant-promoting organisms in the soil require certain conditions under which they can do their best work. These favorable conditions call for moisture, but not excessive moisture. They also call for soil warmth and air, and soil is warmed and aerated best by cultivation, whereas the application of too much water makes the soil cold and closes the air passages. It should be readily understood that irrigation can not take the place of cultivation in any degree, but cultivation can well be substituted for much irrigation.

The first cultivator was probably a pronged stick used by early man to assist his crops. The next form was probably what we would now call a crude form of hoe. Later, as man began to use beasts to help him at his work, the hoe was fastened to a beam to which the beasts were hitched. Later a second hoe or shovel was fastened to the beam and this evolved into the double-shovel cultivator, the

only kind known to our grandparents and which is still giving good service in some sections of this country. Then, as the large fields in the prairie sections of this country came into cultivation, there was demand for a cultivator that would work both sides of a crop row at one passage, and we then had the sulky cultivator, two beams connected by an arch and supported at the front end by wheels—a regular two-horse implement. The more recent development in this implement is known to all; we now have the one, two, three, and four row riding cultivators, which are fitted by different styles of blades or shovels to meet the various requirements of different crops and different conditions. The cultivation of crops with our modern implements is a light task compared with this work 50 years ago, yet our farmers do not cultivate crops more thoroughly now, if as thoroughly, as our parents and grandparents did in their times.

Acting on the practical theory that cultivation of the soil aids the work of the plant-promoting organisms in the soil, it is well to cultivate as early as possible after seeding. Many good farmers cultivate soon after planting and before the plants come through the ground. Then, as soon as the plants come through they harrow the field; harrowing is only another form of cultivation. After the plants are up sufficiently high that they will not be covered by dirt thrown by cultivator shovels, deep cultivation close to the plants should be given. Subsequent cultivations should be increasingly shallow and more distant from the plants to prevent damage to root systems. At least two cultivations between irrigations should be the rule—one as soon after irrigation as the condition of the soil will permit and the next several days before irrigation, when the furrowing shovel should be attached to the cultivator to prepare the irrigation furrows.

The depth of cultivation should be governed by several factors. Plants have different rooting habits; some dispose their root systems close to the surface of the ground and these require the most shallow cultivation. Other crops of deep rooting habits permit and profit by deeper cultivation. Some crops have wide-spreading roots and some have a single perpendicular root. The depth to which the seed bed has been broken also is important. Given a deep mellow ground to feed in plants will strike deep for nourishment, but with a shallow seed bed and a hard and unfertile subsoil the roots cling close to the surface. As a rule plant roots will go down after moisture, and this tendency should be encouraged. If too frequent irrigation is given the roots will secure moisture near the surface and be exposed to damage from cultivator shovels, also the drying action of wind and sun. No single phase of crop production is independent of all other phases; every operation must be done mindful of all the conditions.

In no case should irrigation be substituted for cultivation. Every cultivation properly performed during the period when plants need cultivation is a good investment. If in doubt, cultivate.

THE ROLLER.

The rolling or packing of cultivated ground has advantages overlooked by many farmers. The plain or smooth roller is a farm implement which has been in use many generations, but its use is generally confined to two or three principal operations, such as the rolling of corn ground just before the planter or just before the first cultivation.

Of late years there have come into use various modifications of the roller. One of the most important is a subsurface packer which replaces the roller drum by a number of wedge-shaped wheels set about 4 inches apart on a common shaft or axle. This implement when properly weighted serves to pack or firm the bottom of the plow slice and insures capillary action of soil moisture. Another type has a corrugated drum or roller which makes a better clod crusher and mulch former than the smooth roller; also it packs the soil to a greater depth than the smooth type. Still another type has both corrugations and teeth and this type is reported to give very good satisfaction.

In spring plowing one of the difficult tasks is to properly firm the seed bed. Dragging does much to level and firm the soil, but after the seeding is done much loose dirt will be found. Using the roller at this time will make for quicker germination of seed. Seeds which have to develop a root system in loose earth seldom develop a strong root system and the result is weak plants.

The rolling of meadows and pastures in the spring does much good in placing the plants firmly in the soil and correcting the damage done by frost and freezing which may have loosened the plants and partly lifted them. Spring rolling of fall-seeded grains is beneficial for the same reason.

Use of the roller ahead of the cultivator makes earlier cultivation possible, due to crushing of clods which otherwise would be pushed over on the young plants.

The roller may do harm as well as good. A heavy soil should never be rolled when it is wet as a hard, brick-like crust will result. This should be watched when rolling ground after rains to break up crust formations.

IRRIGATION.

DUTY OF WATER.

The term "duty of water" is so often seen in print and heard in discussions relating to irrigation that many people have arrived at the conclusion that irrigation water has a particular and definite duty; that is, each second-foot or each acre-foot of water applied to land should yield certain definite results in the way of crops. There are many terms connected with irrigation that are misunderstood and misconstrued, and none more so than the term "duty of water." The man who most quickly realizes that irrigation water has no definite duty is the man who personally applies it to the land. Under certain fixed and artificial conditions, such as irrigating in tanks indoors, where all conditions are carefully regulated and noted, we may, by free use of estimates, arrive at conclusions as to what may be secured by adding a certain amount of water to a certain amount of soil in growing various kinds of crops. These conclusions will not hold good in the big outdoors.

In field irrigation, where there are variations in soil strata, soil texture, topography of land, sun heat, direction and velocity of wind, and more than 57 varieties of other natural controlling factors there is sometimes a little doubt as to just what an acre-foot of water will do in coaxing a crop yield to make itself manifest. When you dispose of all these various natural factors, which up to this time have not been disposed of, you may consider for a time the variations in the skill and care of the irrigators and the disposition—common to all irrigators—to steal water that according to rules and regulations formally announced should be flowing into a neighbor's field.

Admitting that, in years to come, some person with a sufficiently elevated brow may dispose of all the factors above mentioned and implied, there is still the interesting problem of determining just how and how much variations in and between seasons affect the duty of water. Nature has a peculiar inclination to furnish us with a continuous change of style in seasons. No two seasons are just alike or nearly alike, and no cycle of seasons is just like any other cycle of seasons. At times rains help the irrigator, and at times come when not welcome. A dry season following a dry season is more dry than a

dry season following a wet season; and a wet season following two wet seasons is more wet than a wet season following two dry seasons.

Averages as to the duty of water may be stated, but averages are misleading so far as they apply to the individual farmer. For example, 2,000 acre-feet of water may be used in a season on 1,000 acres of land, and it is readily understood that the average use of water was 2 acre-feet per acre, and the average duty of 1 acre-foot of water would be to irrigate a half acre of land. To charge for water on this basis would usually be unfair, however, as a part of the 1,000 acres by reason of character of soil could produce a crop with 1 acre-foot of water per acre, and other portions of the 1,000 acres would require from 3 to 15 acre-feet of water per acre.

On my own farm I have found that what I can accomplish in one field with an acre-foot of water I can not accomplish in another field. Every irrigator experiences this. The results accomplished by an acre-foot of water vary in different parts of a small field. The Department of Agriculture has been making studies of the duty of water on my farm for a number of years. The reports made by the men assigned to this work show me great variations in the duty of water under what on the surface appear to be similar conditions. I find that where a reasonable amount of water is evenly applied to a field some portions of the field are really overirrigated, and on other portions most of the water immediately passes down beyond the reach of plant roots.

The term "duty of water" should be used less, and some such term as the "duty of irrigators" used more. There is no variation in the duty of irrigators, which is to use every acre-foot of water to the best advantages.

IRRIGATION HEADS.

The volume of water applied to the land by the irrigator is usually termed the head of water or irrigation head. This head should vary with and be governed by (*a*) the amount of water available; (*b*) the kind of crop being irrigated; (*c*) the character of the soil to which the water is applied; and (*d*) the topography of the land.

Where the amount of water available is limited, small irrigation heads may be the only recourse. If the general conditions are right for the use of large heads, it would be economy for the neighbors to rotate the available water between farms in such manner as to make it possible for each to use, in his turn, the largest head that may be handled properly. This would save time for all and also secure the most efficient use of the limited supply of water.

Where the crops grown are shallow rooted and can not be cultivated, the head may be so controlled as to provide shallow irrigation

and frequent applications of water provided; or, if the ground is fairly well shaded the soil may be well wet up without undue loss of water. In case of cultivated crops the head may be regulated to wet the soil to a considerable depth, and then this moisture may be held for the use of the crop by timely cultivation. It is generally claimed that heads large enough to flood the crowns of such plants as sugar beets should not be used, though good authorities hold that no damage is done to the crops unless the water is permitted to stand against the plants for a considerable time.

The character of the soil is probably the greatest factor affecting the irrigation head. On sandy and gravelly soils small and slow heads sink into the subsoil and it is impossible to force the small head over a wide area. On heavy or "slick" soils a hurried irrigation with a large head fails to wet the soil to a depth sufficient to do any good. On light and silty soils large heads wash the soil, expose the roots of the plants, and disarrange the surface of the land.

On the sandy and gravelly soils, large heads which will not unduly wash the soil should be used, and the farm laterals should be arranged relatively close together so the irrigation head may be changed from one area to another without loss of time. On heavy and slick soils the head may be distributed over a larger area and traveled slowly to give the water time to sink in; also, the distance between the farm laterals may be increased considerably. On the light silty soils where the water is applied to the bare soil the only practical plan is to use a number of small heads or "trickles" with short distances between farm laterals. These small heads may be continued in one place for a considerable time or until the soil is well saturated. Where the soil is dry and hot and the "trickles" are exposed to the sun much of the water will be lost into the air, but if the run is continued miniature gullies are cut into the soil and in these the water is protected from the sun and greater efficiency is secured.

The topography of the land helps or hinders the use of advantageous irrigation heads. For example, it is much easier to use a large head on gently sloping and nearly level land than it is on terraced or rolling land. Much skill and ingenuity must be exercised in handling water on uneven land in order that the water may be kept in control, otherwise the low places will receive more than their share of moisture and the high spots will not be touched.

The irrigator should not get into a rut in the matter of the size of the irrigation head he uses. I have pointed out some of the conditions which affect the size of the irrigation head, and these conditions change on each farm from time to time as the land becomes better surfaced and the soil is changed by the rotation of crops. The farmer should endeavor continuously to use the most advan-

tageous irrigation head. It means saving in labor and economy in the use of water.

IRRIGATION TOOLS.

In some of the old readers used in the country schools years ago was a story of an interview between a renowned painter and a student of art. After going into raptures over the work of the painter, the art student asked the question, "With what do you mix your paints?" The painter replied, "With brains, sir." That would be a good reply to the often-asked question, "What do I need to irrigate with?"

Intelligently handled, water is a willing and always obedient servant; uncontrolled, it is a hard master.

The first important step in irrigation is a comprehensive and effective layout of ditches. Next comes a proper preparation of the land for receiving the water. This means grading and leveling the land so the water will reach all the land evenly. In the leveling of the land is where much of the back-breaking work of irrigation may be done away with and where the use of special tools or equipment is made unnecessary.

For cutting down high spots and filling holes any of the scrapers or graders well known throughout the country may be used. For finishing off the land and leveling it there is nothing better than the float or drag, which is constructed of 2 by 6 or 2 by 8 inch plank set on edge, 16 to 18 feet in length and 6 to 8 feet in width. Three crosspieces are used—one at each end and the third in the center. The end crosspieces are made to slant forward at the top and the center crosspiece or cutting edge is upright and should have a piece of steel on the lower forward edge, where wear occurs. The float should be well braced and supplied with planks on the top to enable the driver to shift his weight to different parts of the float to assist in the loading and unloading of the cutting blade. This float used properly on fresh-plowed land will save much work and water during the heat of the summer, when both are valuable.

With the farm ditches well located and built and the land properly leveled, irrigation becomes a simple matter, as the additional equipment needed is limited in most cases to a furrower, where furrow irrigation is practiced, a supply of canvas dams, a trusty shovel, and, a strong, quick-thinking and quick-acting man.

The furrower may be a homemade contrivance, which will drag out small furrows at stated intervals apart, or it may be one of the patented furrowers now on the market. The canvas dams are used for checks to force the water out of the farm ditches onto the land. They have been found the most practical for this use. The plan of making dirt checks is comparatively rapid, but it has its drawbacks,

the principal one being that in some soils dirt checks will not hold well under a large head and the water frequently gets beyond the control of the irrigator.

There is no such thing as automatic surface irrigation of large tracts of land, but the nearest approach to this is where the land is well surfaced and supplied with proper distributaries. With this accomplished, and this is where irrigating with "brains" is demonstrated, there is no need for an endless number of patent contrivances. Irrigate with "brains."

IRRIGATION LATERALS.

We often hear the statement that irrigation farming would be more attractive if it were not for the excessive amount of work necessary to irrigate the crops. It is admitted, of course, that there is work connected with irrigation. The choice between ordinary farming methods and irrigation farming must be made on the basis of whether it is better to worry about the crops getting the necessary moisture or to work a little in putting the water on the crops.

Much of the talk about the excessive work necessary to irrigate land would be dispelled, however, if the irrigators would irrigate to the best advantage. The first essential is plenty of farm laterals, properly located and substantially built. You can no more reasonably expect to easily and successfully irrigate land through a faulty irrigation system than you may expect to travel speedily and comfortably over poorly constructed highways. Water is inclined to travel in the line of least resistance and is controlled entirely by gravity. If the main lateral brings to your farm a good and sufficient supply of water you can make your work of irrigation easy or difficult according to the manner in which you undertake to handle the water on the farm. Lay out your farm system so that you can irrigate the crops with the least possible work and with economical use of water. Do not wait until it is time to irrigate before you arrange your farm ditches. The farm laterals or ditches must be constructed on accurate grades and subject to a plan which takes into consideration the contour of the land, the nature of the soil, the amount or head of irrigation water to be used, and the kinds of crops to be irrigated. All ditches, irrespective of size, must follow the ridges on the land. Water can not be carried uphill and down in open ditches. Don't expect to coax the water uphill. Build the ditches in size according to the amount of water they will be required to carry. In computing the sizes of the ditches do not lose sight of the fact that the slope or grade of the ditches is as much a factor in determining the capacity as is the size or section of a ditch, i. e., a small ditch with considerable fall will carry as much water as a much larger ditch with less fall.

Another important factor in determining the sizes of ditches is the nature of the soil. Soil that washes easily requires ditches built with but slight fall, while clayey soils and others that do not wash easily may be constructed with greater fall. If the soil is light and sandy and the land is rolling; it will be necessary to construct checks and drops in the canals to prevent erosion in the bottoms of the ditches.

Have plenty of laterals and cross laterals constructed. As a rule short runs of water are most economical both in water and time, and the water is more easily controlled. You create but small waste in taking up considerable land by small ditches. As a rule you will find that the crops bordering on the ditches are enough better than the average for the field to pay for the ground taken up by the ditches. By spending one hour in laying out your farm ditches you may save two hours' time in irrigating.

The saving in labor in irrigation is not, however, the only reason for a proper layout of farm ditches. The irrigation of a crop is usually done at a critical period in the crop's growth—when the crop needs water. It is important, therefore, that the water be delivered quickly and efficiently. It is poor policy to put dependence in a system of poorly located and faultily constructed farm ditches. When you build your laterals, build well.

CHECKS AND BORDERS.

In some of the oldest irrigated districts of this country irrigation water is spread over the land by what is known as the check system and also by a modification of that system known as the border system.

Irrigation by checks makes necessary the laying off of the irrigable land into small checks or tracts each surrounded by a small embankment. The water is turned from the lateral into one of the checks, usually the one of highest elevation, and when the ground is sufficiently moistened the head of water is directed to another check. The fitting up of land for check irrigation is comparatively expensive, but when properly fitted the actual work of irrigation is easily accomplished. The first requisite for check irrigation is, of course, properly fitted land. Each check should be nearly level. If high and low spots are left within a check, it will be necessary to provide high embankments in order to force water over all the land within the check. Parts of the check will be flooded deeply in order to get water on the high spots, and flooding is damaging to many kinds of crops. If the fields to be irrigated by the check system are practically level, the checks may be rectangles all of equal size. If the land is rolling, the embankments must follow the contours of the land, in which case the checks will vary in size and shape.

The border system of irrigation is a modification of the check system and consists of borders or embankments which guide the water over narrow strips of land. The width of the lands between the borders is usually about 50 feet and the length of the lands may vary from very short lands up to those 800 feet long. In fitting land for border irrigation it is necessary to make the strips or lands between borders level crosswise in order that the water may spread evenly between the borders and move down the land well distributed. The fall of the lands should be as nearly regular as is practicable in order to prevent the water piling up in low places. The lengths of the strips or lands are governed by the fall of the land and the character of the soil. On porous soils the upper ends of the lands will take up too much water before the lower ends of the long lands become sufficiently irrigated, so in the case of porous soil it is necessary to make short lands and use rather large heads of water.

The use of the check and border systems of irrigation should be confined as much as possible to level lands and gently sloping lands. Under these conditions the principal advantage from these methods of irrigation is the careful check which may be kept on the amount of water used, as a certain head of water may be confined for a specified time on a measured area of land. Other advantages are the rapidity with which irrigation may be accomplished and the assistance rendered by the embankments and borders in controlling the water.

Among the disadvantages of these methods of irrigation may be mentioned the cost of fitting up the lands for irrigation and the inconvenience of cultivating lands which are fitted up with numerous embankments and borders.

IRRIGATION OF ORCHARDS AND GARDENS.

The irrigation of orchards and gardens is given but little attention except in those sections of the country where the production of fruits and vegetables is specialized. On the average farm where diversified farming is followed the irrigation of the trees, shrubs, and plants amounts to no more than the incidental spilling of a little water down the rows where the crops in adjacent fields are being irrigated.

That special attention to methods of culture and irrigation of fruits and vegetables is worth while in sections specializing on these crops is proof that the same special attention is worth while on any farm in any section.

It has been demonstrated that the color and flavor as well as the texture of fruits and vegetables may be influenced greatly by the methods of irrigation and cultivation followed. These products are among those where the price and demand are influenced directly by appearance, flavor, and texture; therefore measures which will improve these factors are worth while.

The general rule for irrigation of vegetables is to keep the ground moist from seeding time until the period of ripening is reached, furnishing the greatest amount of water at that stage of growth, as when the peas are forming in the pods or the tomatoes are setting on the vines, then reducing or shutting off the water sufficiently and in time to permit the vegetables to ripen or come to maturity naturally. When water is applied in too great quantities and for too long a period the quality of the vegetables deteriorates. In some sections of the country some vegetables are kept green and are caught by frost before they are given time to ripen.

In the irrigation of orchards we have a question on which "doctors disagree." It is difficult to get two fruit growers to agree on just what plan is best. In the warmer sections where heavy freezes are not experienced every winter some of the difficulty of irrigating orchards is removed. Where cold weather is experienced care must be taken to prevent injury. It is generally conceded that water should be furnished the trees to permit them to make healthy growth up until July 15 to August 15, depending on the length of the frost-free season, after which water should be withheld to permit the new growth of wood to ripen thoroughly before freezing weather. Where it is possible to irrigate trees in the late fall or early winter it is good policy to do so, but care should be taken not to apply water early enough to start a second growth as this second growth would go into cold weather soft and the trees would be quickly injured or killed. These late irrigations will prevent the trees drying out unduly during winter and enable them to make an early start in the spring.

For gardens and orchards the furrow system of applying water is both the most effective and labor saving. In order that the trees may be induced to develop symmetrically, water should be fed to them from all sides, which is effected by circling the tree with the furrow. The root system of a tree is usually understood to extend as far out as does the branch system; therefore, as the trees grow the irrigation water should be well applied over a corresponding increasing area to place the moisture well within the reach of the entire root system.

Frequent and thorough cultivation should be insisted on for both orchard and garden. Thorough cultivation lessens the danger of overirrigation.

After fruit trees have reached their full growth it has been found best in some sections to discontinue cultivation of the ground and to seed cover crops such as clover, alfalfa, or some grass. Some authorities claim this the best system to follow in order to keep the trees in healthy condition.

IRRIGATION OF CULTIVATED CROPS.

The irrigation of cultivated crops is comparatively simple, but the results obtained from irrigation of these crops vary greatly with the skill and judgment used in irrigation with respect to time of irrigation and amount of water used. The furrow system of irrigation is naturally adapted to cultivated crops, as the cultivator used prepares without extra labor the furrow for the stream of water. Years ago it was the custom in some sections to use the border and check systems, by which the cultivated crops were flooded, but this plan has been discontinued in favor of the more economical and simple furrow system, and partly for the reason that covering some cultivated crops with water has been found injurious to the plant growth.

In soils where the water spreads rapidly in the soil it is only necessary to run streams of water so that one stream serves two rows of crops; in cases where the soil is of such nature that water will not spread quickly through it, it is necessary to run a stream of water for each row of crop. As many crops are easily injured by sun scald, it is well to make the furrow deep enough to confine the water and prevent it touching the plants direct. Where at all possible, cultivated crops should be planted on fall-plowed ground and in which there is a good supply of moisture at time of planting. If the ground is dry at time of planting, it is well to irrigate before the seed is put in and then cultivate immediately after planting to prevent escape of moisture.

Do not try to replace cultivation by irrigation. Less water should be used in irrigating cultivated crops than on other crops, as cultivation should, by conservation of moisture, make unnecessary the application of the amount of water used on crops not cultivated.

The first irrigation should be delayed as long as possible without stunting the plants, as this encourages the roots to drive deep into the soil, which makes for stronger growing crops and less frequent irrigation. This plan also gets the plant roots deep enough to prevent their being cut by cultivation.

The general rule for time of irrigation is to apply the bulk of the water just before the time when the plant naturally makes its most rapid growth; this places the water at the disposal of the plant when it is most needed, and the important growth is therefore natural and seasonal. Care should be taken not to continue irrigation after the plant has made its natural growth, as such additional water delays the ripening of the crop and hurts the quality of the crop.

By all means cultivate thoroughly. It should be borne in mind that you will not overcultivate, while it is easy to overirrigate. Two cultivations to each irrigation will not under any ordinary conditions be too much. Keep just enough moisture in the soil to make plant

growth natural, and depend upon cultivation to encourage the growth by warming up and introducing air into the soil.

IRRIGATION OF SMALL GRAINS.

Usually the first crops produced on irrigated land are small grains. This is due to the fact that in the locations of our irrigation projects small grains find a natural home, whereas corn and other cultivated crops require special care and experience in maturing of the crops. Also, small grains withstand for short periods excesses of drought or water and the inexperienced irrigator is able to secure a crop while he is learning how to irrigate. As the irrigated districts become more firmly established the production of small grains gradually gives place to other crops such as alfalfa, sugar beets, potatoes, fruits, and others giving larger returns per acre and the production of small grains is put over on the dry-farming sections.

The ordinary plan of irrigating small grain is by the flooding system where the farm laterals are run on the highest places of the field and the water turned out of these farm laterals to flood or spread over the surface. The exceptions to this plan are in sections where the water supply is limited and where it is necessary to carefully prepare the fields in such manner as to secure the best possible use of all the water. In these cases the border or check system and the furrow system are availed of. In irrigating small grain by the flooding system first mentioned, more irregular surfaces may be irrigated, but in irrigating by the check, border, or furrow system care must be taken to prepare the fields so that the surface is regular and the water easily controlled.

In producing wheat under irrigation scarcity of water may be overcome by planting fall or winter wheat which makes the best possible use of fall and winter rains and is usually matured by but one irrigation. Grains planted in the spring require from two to four irrigations, depending on the character of the soil and the amount of rainfall during the growing period.

The same methods of irrigation may be applied to wheat, oats, and barley with the exception that overirrigation is less injurious to wheat than to oats and less injurious to oats than to barley.

The time of irrigation is influenced a great deal by the time of rainfall in the period of growth. Where grain is planted in dry ground in the spring it is necessary quite often to irrigate the field in order to germinate the seed. Some authorities favor irrigating the ground before planting the seed, but the objection to this method is the delay necessary to irrigation and waiting for the soil to get in condition before the seed is planted. By planting and then irrigating, the water immediately hurries the germination of the seed and

furnishes moisture necessary for the early growth of the plant. After germination of seed and first growth of the plant the irrigation should be delayed until the appearance of the plant indicates need of moisture. The plants are naturally a light green; as the need for moisture grows the plants turn a darker green, and unless moisture is supplied the dark green turns to yellow and the plants are permanently injured. If possible, it is well to keep an even amount of moisture available for the plants. The period of most rapid growth comes just about the time of bloom when the plants shoot up, and plenty of moisture should be available at this period. The quality of the grain, as well as the quantity, may be helped by plenty of moisture at the time the grains are forming. If the moisture is shut off at this period shriveled and undeveloped grains will result.

The quantity of water required for best yields of small grains is something each farmer should endeavor to work out as he may under the conditions which he has on his farm. Heavy and clay soils require less water for maximum yields than sandy and gravelly soils. Where average conditions exist about 18 inches of water should mature grain well on clay soils; sandy or gravelly soils would probably require 30 or more inches for the same yields. This important fact should be borne in mind—the yield of both grain and straw increases with the application of water up to the amount which the plants need for their best development; if the application of water is continued above this point the yield of both grain and straw will decrease in proportion to the amount of excess water.

Some authorities have put forward claims to the effect that small grains will yield best by a certain program of alternating dryness and moisture. It is believed to be well for the average farmer not to experiment with any such theory, as it is a theory at the best and no one can say definitely just when the soil should be dry and when moist on every farm. The best plan for the farmer is to endeavor to keep available for the plants just as much water as keeps them in healthy growth and time his irrigations to the periods when the plants need the maximum amount of moisture.

IRRIGATION OF ALFALFA.

There is no material difference between the methods of applying irrigation water to alfalfa and those employed in irrigating other crops. The principal variations in method are due to local custom and soil conditions.

Where water is plentiful and available in large heads the flood system is usually employed; where the water supply is limited and only small heads may be secured the furrow system is advantageous; also the border or check system is readily adapted to the irrigation of alfalfa.

For the flood system the farm ditches are arranged at the time of seeding the crop. The ditches are so arranged that they control the entire area of the field and so constructed that they interfere as little as is practicable with the handling of the crop.

For the furrow system the field is marked off into shallow furrows just after seeding and these furrows become permanent with the stand of alfalfa. It is best to run the furrower through the furrows at least once each year to clean them out so that the water may not be obstructed. A cleaning of furrows after each cutting is economy. The water gradually feeds into the soil between the furrows until the entire surface is wet.

Where the border system is used the fields are best laid out in strips 25 to 75 feet in width (preference being given to the narrower) and from 200 to 600 feet in length (preference being given to the shorter). Small ridges or levees guide the water down these strips, the water being applied in sheets covering the land between the levees.

For the check system the entire field or any part of the field is surrounded by a levee and water run in until the entire surface is covered.

The time of irrigating alfalfa is a matter concerning which there is much debate. Alfalfa does best when the soil contains just the amount of water it can use to advantage; too much water produces poor hay and too little water makes a short crop. It has been found profitable to make later fall irrigations, provided it is certain the water will be absorbed into the soil. If water freezes on the surface the stand of alfalfa will be destroyed. If winter rains are plentiful it is best not to irrigate in the late fall, as an excess of water in the top foot or two of the soil during freezing weather tends to winter-kill the alfalfa. Also, if the soil contains an excess of water in the early spring the alfalfa will make a slow start, due to the delay in the soil warming up.

The first irrigation in the spring should be delayed as long as possible without checking the growth of the plants. This will permit the soil to become warm and encourage the roots of the plants to strike deeper into the soil.

Seasonal and soil conditions control to a considerable extent the amount of water to be applied at one time and the frequency of the applications. Dry and windy weather makes heavy applications of water necessary, and soils which will retain but a small portion of the water applied require frequent light irrigations, though it should be borne in mind that alfalfa is a deep-rooted plant and no opportunity should be lost to encourage the roots to go deep into the soil for moisture.

The rule adopted by many alfalfa growers is one irrigation for each cutting, and ordinarily this is sufficient. In some sections one irrigation is given before the first cutting and one after the last cutting, with one irrigation between the cuttings.

If the rule of one irrigation for each cutting is followed, there remains the question of whether it is best to irrigate just before or just after the cutting. Irrigation before the cutting has the disadvantage of making the distribution of water more difficult, due to the heavy growth of the crop; also it is claimed that the hay cures better on dry than on moist land. Irrigation after cutting is more easily accomplished, but it has the disadvantage of permitting the soil and the plant crowns to dry out, and the second cutting comes on more slowly than is the case when the ground is moist when the crop is taken off.

Don't over-irrigate your alfalfa. If an excess of water is applied the plants will endeavor to throw off the excess into the air, and in doing so the natural condition of the plant is changed, and coarse, woody hay results. On the other hand, too little water results in scanty foliage.

A saving in irrigation may be accomplished if the alfalfa field is cultivated well with the disk, harrow, or special alfalfa cultivator at least once each year. The best plan is to so cultivate the field early in the spring and again after the last cutting.

On fairly good soils, in sections of 12 to 15 inches of rainfall per year, 18 inches of irrigation water should be sufficient to produce three cuttings of alfalfa. This duty of water may be changed, due to more or less rainfall or soil and weather conditions.

You can influence the quality of alfalfa hay by the amount of water applied. Try to give the crop all the water it can utilize without inducing rank growth.

IRRIGATING WHEAT.

Wheat is the one crop in which we are all interested. The quantity and quality of the grain produced is influenced much by irrigation and much damage is likely to be caused by the late irrigations. Experience and experiments show that little good is accomplished by irrigations after the bloom stage has been passed. The earlier irrigations have the greatest influence on the crop in matter of yield, and if there is plenty of moisture in the soil when the wheat is in the "boot" or just starting to head it is all that is necessary to make the crop.

Late irrigations—that is, after the wheat has passed the bloom stage—are likely to cause damage to the crop by "lodging," as when the heads become heavy the straws are likely to break over.

IRRIGATING POTATOES.

The Utah Experiment Station has conducted experiments in the irrigation of potatoes, and the results as set out in a bulletin issued by that station are summarized as follows:

The highest yield of potatoes was produced where small regular irrigations were given.

One inch weekly, or a total of 12.8 inches during the season, gave a higher yield than any other treatment.

When as much as 96 inches of water were applied the yield was less than where no water was given.

Watering the land after planting the potatoes and before the plants were up reduced the yield below that where no irrigation was given.

Where but one irrigation was applied, it gave best results if applied when the potatoes were in full bloom.

The second best stage was just as the tubers began to form.

Discontinuing irrigation during the rapid growing season, after it was once begun, decreased the yield.

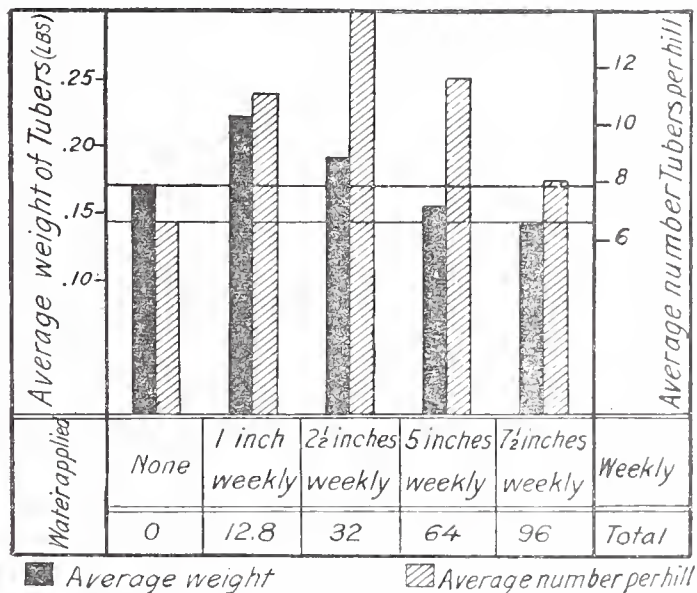
Excessive moisture, or that applied late in the life of the plant, increased the relative production of vines.

The relative number of tubers per hill was increased by early irrigation where the relative size of the tubers was influenced more by late water.

Height of vines was affected much less by the treatment than yield of tubers.

The experiment brings out the importance of an even supply of soil moisture during the middle portion of the life of the potato after the tubers begin to form and before they begin to ripen.

The accompanying diagram also helps to bring out the valuable points of these tests.



Weight of average hill and average height of vines on plats receiving different quantities of irrigation water weekly. Results for five years.

A FEW CROPS.

GOOD SEED.

One of the most beneficial features of the campaign for better farming is the widespread insistence for good seed. The old theory of "like begets like" holds good in the plant life as well as in animal life. Thorough cultivation is necessary to good crop yields, but the extra touch in cultivation will not be found so profitable unless good seed is planted; thorough cultivation and good seed do fine teamwork when it comes to producing bumper yields.

I have noticed the statement that plowing matches held in certain sections of the country year after year for several generations have had a most beneficial effect on the farming methods of those sections. Not only has the best of plowing become a habit with those people, but all other features of the farm work have been given due attention, and the result is that the farms in those sections are one and all models. It matters not what feature of farm work you start to improve, you will improve all other features with it. If farmers buy good seed they will decide that good seed deserves good seed beds and that the growing crop should have special care; also, they will not relish feeding these carefully grown crops to scrub live stock. Therefore, when you improve any feature of farm work you improve all the farm work. We all know that mumps, measles, hog cholera, weeds, and gossip spread from farm to farm, but we often forget that the good things also spread, and there is nothing more contagious than a good example in farming. Plant good seed, take good care of the crop, tell what you have accomplished, and it will lead your neighbor to follow your example.

You do not have to send away to some distant part of the country for good seed. The best seeds for your uses are those produced in your neighborhood, and you should now have your seed ready for the next season's planting. Select your seeds from the fields and not from the bins and granaries.

When our forefathers got ready to plant corn they went to the corner, picked out some likely looking ears, and by biting off the small end of a kernel or two from each ear decided whether or not

the corn would grow. When they planted this corn they kept in mind the old idea of—

One kernel for the blackbird,
One for the crow,
One for the cutworm,
And three to grow.

By slandering the blackbird and the crow and by assuming that the cutworm would be obliging enough to take but one kernel from each hill they succeeded in getting fair stands of corn. Many of the tables we see printed nowadays giving the amounts of various seeds to sow per acre are relics of the time when the farmers did not test their seed, and most of these tables should be revised to meet the requirements of these days, when we expect every seed we plant to grow.

PREVENT SMUT.

Just a reminder about treating your seed wheat and oats. A heavy per cent of the oat and wheat crop of this country is lost each year because the farmers do not take steps to prevent smut.

It is easy to treat seed to prevent smut; it is also inexpensive. A pint of formaldehyde put in a barrel of water will treat 40 to 50 bushels of grain, and the gain in yield will many times repay the cost and labor involved.

When planting your spring grains do not be in too much of a hurry—take time to treat your seed to prevent smut.

CORN.

It is not likely the American farmer will give up growing corn whether he lives in the so-called "corn belt" or in some irrigated valley far removed therefrom. Corn is one of the greatest food-producing plants and should be grown wherever possible. It is particularly valuable as a flesh producer when fed with alfalfa.

Lack of moisture is not the only barrier to corn production. Corn requires a considerable amount of heat to bring about maturity, so we may consider heat one of the most important factors in corn production. On our northern projects, where the frost-free season is short and the nights cool, everything possible must be done to take advantage of all the heat available in the growing season.

The small and young corn plant requires but a small amount of moisture. Frequent cultivation in the early stage of corn growth will produce more good than irrigation. Cultivation warms the soil and irrigation cools the soil; heat is what the young plant needs. It should be kept in mind that early in the season irrigation water will be much colder than that which may be had later in the season. If there is sufficient moisture in the soil to keep the corn plants growing,

postpone irrigation as long as good growth continues. If the ground is kept continually wet the corn will develop into rank and watery growth of stalk, which is unable to produce good ears. The corn plant requires the most moisture at the time when it begins to put out tassels and silk. Water applied at this stage will be utilized in making grain rather than stalk. But here is the important factor to be kept in mind. If you have sufficient water in the soil to enable the corn plant to mature its grain, shut off all irrigation water and permit the plant to mature.

Irrigation of corn is a simple matter, as the furrow system may be followed easily, using the furrows left by the cultivator.

The irrigation requirements of corn may be summed up as follows: Irrigate as little as may be during the early stages of growth; maintain heat in the soil by cultivation. Furnish the bulk of the moisture at the time the plant needs it to make grain. Shut off all water in time to permit the plant to mature.

I recommend to our project farmers that they put in a few acres of corn convenient to the farm stockyards so it can be harvested by sheep or hogs in the fall. The very early dent or the flint varieties for the north and later strains for the south should be selected. It will be found a paying proposition. If the corn does not mature it can still be used as forage.

RYE.

I hope all our farmers will not quit growing rye simply because the entire country bids fair to go "bone dry" during the war or longer. Rye has many good uses, and particularly on some of the poorer lands on our projects it would be found a great help if properly handled.

Rye is hardier than wheat and can be grown in colder places and on poorer soil than wheat. An acid condition in the soil does not appear to hurt this crop so much as other grain crops are injured by acid soils. It will germinate and grow with the temperature only a few degrees above freezing. This makes it an ideal crop to put in as a catch crop after other crops such as early grains, potatoes, etc., have matured. It makes a good winter pasture and can be turned under in the spring as a green manure—for which it is excelled only by the regular green manure crops such as cowpeas or soy beans.

Rye is attacked by but few diseases or pests and matures early enough to escape serious damage by rust.

Taken all in all, rye is a very valuable crop for winter pasture to save high-priced hay and for turning under in the spring to put the soil in better condition.

GRAIN AND GRASS.

If we judge by newspaper publicity the world lives mainly by grain. There is no doubt the grain end of the human ration is at this time in a critical condition, yet we should bear in mind that man does not live by grain alone. The immense amount of pressure being brought on the farmers through all sources of communication is bound to effect a tremendous swing to grain production. There is an element of danger in too great a movement toward grain production in that we may neglect the production of food for live stock to the end that dairy and meat products, already costing the public an alarming price, will pass beyond the reach of the average purse. Experienced stock feeders are at present prices of feed and feeders showing some hesitancy in investing their money. The amount of money which must be invested under present prices to finance the feeding of cattle or sheep is entirely out of proportion to the profits usually realized. Dairymen who have heretofore been able to make profit at prevailing prices for retail milk now find all their receipts eaten up by the advancing prices for live-stock feeds. There are but two courses open—prices for products furnished the public must go up or the prices for live-stock feeds must come down. When the producer can not produce at a profit he will quit producing, and herein lies a great danger to the public—the farmer included. Any decrease in live-stock handling means a decrease in farm fertility. The farmer should increase live-stock production both on the farm and in the feed yards. The way is through the increased production of grasses and forage. An increase in the acreage of alfalfa on our irrigated lands will answer the question for our farmers.

Wherever alfalfa is grown in plenty there will be found live stock in plenty. Wherever there is live stock in plenty will be found soil fertility, prosperous farm homes, and thriving communities. The prosperous communities in any part of the country are the communities where live-stock feeds and live stock are plentiful year after year, and these are the communities which are “doing their bit” in sustaining the country now and which will do more than their share in any protracted struggle in which this country may engage. In peace or in war a country lives not by grain or by grass, but by grain and grass, and if there is any difference the greater of these is grass.

MIXED PASTURES.

The very creditable movement for the establishment of permanent pastures on irrigated lands is making considerable headway. While for hogs there is nothing more profitable than straight alfalfa pasture, the losses from bloat among cattle and sheep on alfalfa pasture have made many farmers give up pasturing alfalfa. The solution is to put in mixed pastures.

In discussing this subject some objections are heard to putting in permanent pastures for the reason that "irrigated land is too expensive for pastures." The best answer to this objection is the fact that in the portions of this country where land is highest priced large areas are given over to pasture and yield good returns. In England, where land is still more expensive, the ordinary farming plan is to have a great portion of the holding in permanent pasture which is liberally fertilized.

The particular advantages of a mixed pasture are based on the following conditions:

No single pasture plant is best for all soils and seasons.

Different pasture plants have varying rooting and feeding facilities and different plants may use the same soil.

Different plants start their growth and mature at different periods of the growing season, and a proper mixture furnishes growing pasture throughout the season.

The mixtures of grasses suitable for pastures on irrigated land are given for the use of readers who may be considering putting in permanent pastures in the spring, which is the best time to start permanent pastures.

For bench lands under irrigation (per acre) :	Pounds.
Kentucky blue grass -----	12
Bromus inermis -----	8
Perennial rye grass -----	6
Orchard grass -----	3
White clover -----	2
Red clover -----	2
Alfalfa -----	2
For light sandy soils under irrigation (per acre) :	
Kentucky blue grass -----	8
Meadow fescue -----	12
Tall meadow oat grass -----	5
Bromus inermis -----	8
White clover -----	2
For low moist lands (per acre) :	
Perennial rye grass -----	8
Redtop -----	10
Rhode Island bent grass -----	4
Meadow fescue -----	4
Timothy -----	2
Alsike clover -----	5
White clover -----	2

If you plan to keep live stock, which you should do, you will find it to your advantage to have a good permanent pasture. You should arrange this pasture with fences so one portion may be used while another portion is being irrigated and started anew. A good pasture properly used is one of the most profitable uses for your land.

SUPPLEMENT THE PASTURES.

Late in the fall the stock pasture gets thin and dry and unless some extra forage is available there is a "let down" in the live-stock ration between the time of succulent pasture and the regular winter feeding. This means also a "let down" in the condition or performance of the stock. This is the time to work into good use the miscellaneous roughage to be found on every farm, whether it be rakings from the grain field or "pick-ups" from gardens and truck patches. Unless these odds and ends are used in the fall they are wasted. Utilize to the best advantage every bit of roughage or forage you can find about the farm; let such feed supplement the pastures where possible and save the valuable hay and grain as much as is possible until the time it must be used.

WARNING—SWEET CLOVER HAY.

Of interest in connection with the widespread agitation in favor of sweet clover is the notice published in the Powell (Wyo.) Tribune by Mr. Don G. Margruder, agriculturist for the Department of Agriculture on the Shoshone project.

SWEET CLOVER STRAW BAD FOR HORSES.

Some recent cases of sudden and unexplainable deaths of horses were investigated this week and indications seem to point to danger from feeding sweet clover straw in unlimited quantities. A post-mortem was held on a horse that had belonged to A. D. Hardy and it was found that the large intestine was greatly distended with a mass of this straw. Remedies that would probably save a horse in this condition might perhaps be a big dose of raw linseed oil when first taken sick and a generous injection of soapy water administered by force pump.

DON G. MAGRUDER.

Our water users should bear this in mind. I saw this sweet clover straw at the time it was thrashed. The sweet clover had been cut a little green and when thrashed was not brittle but came from the thrasher a fluffy, stinky mass which had the appearance of good straw. The fiber in the straw, however, was unbroken and was practically indigestible. A hungry horse given free access to this straw would eat more than its digestive tract could handle and a "packed" condition would result.

BEANS.

In farming under the conditions existing on most of the irrigation projects it is unwise to "put all your eggs in one basket." One of the best ways to find a market for a crop is to grow something that is in demand.

Pick up a half dozen of the high-priced magazines and periodicals of general circulation in this country and notice the numerous expensive advertisements of cooked canned beans. All these advertisements dwell upon the fact that beans are good food. The advertisements are creating a market for beans, and as a result of this advertising the demand for beans will grow; beans are not now a drug on the market.

Take advantage of this and grow a few acres of beans.

In addition to being a cash crop beans have other important advantages. The pulse family or group of plants, of which the bean is a member, is a soil builder, in that these plants gather nitrogen from the air and store it in the soil. This adapts the bean to any plan of crop rotation. Beans are easily handled after thrashing; they may be safely stored awaiting marketing. This gives an advantage over most cash crops. Bean straw is nutritious forage for cattle and sheep and is a good substitute for clover or alfalfa, which adds another source of profit to this crop. Cull beans make good feed for hogs and sheep; they should be cooked and fed with corn or small grains to hogs, and they may be fed raw, whole or ground, to sheep. There is no waste in connection with the bean crop.

Beans may be grown successfully on any of the reclamation projects. With reasonable care and intelligent handling, they may be expected to yield 1,200 to 2,000 pounds of thrashed beans to the acre.

The western portion of the United States should afford a market for beans of good quality at \$4 per 100 pounds. The San Francisco market for small white beans in 1913 ranged from \$4.50 to \$5.85 per 100 pounds. The Mississippi Valley and eastern market ranged considerably lower.

No special equipment is necessary for the planting and cultivation of beans. They may be drilled in with an ordinary grain drill by stopping up sufficient holes to make the rows the required distance apart. They may be cultivated with ordinary corn, cotton, or beet cultivators, though beans do best with shallow cultivation.

If a considerable acreage of beans is being handled in one neighborhood, it will pay to cooperate in the purchase of bean harvesters and thrashers, as the work will be lessened and cheaper if modern machinery is used for this work.

I wish to impress upon the irrigation farmers the desirability of growing varied crops. This distributes the farm work so that all the time may be put in to advantage. It also distributes irrigation work in such a way as to effect more economical use of water. By choosing a good crop rotation, which includes soil builders, the fertility of the soil will at the same time be maintained. The farmers should choose crops yielding good cash returns, and the bean crop should not be overlooked.

Write to the Department of Agriculture and ask for bulletins on beans and other members of the pulse group and learn about a money-making crop that you are now disregarding.

SUGAR BEETS.

With the present rapid increase in the beet-sugar industry there comes an opportunity for our Government irrigation projects to secure the establishment on the projects of an industry which is important to the welfare of all interested in the projects.

The sugar beet, as we know it, is the result of careful plant improvement. It is a plant that has been to college, so to speak, and to work to the best advantage it requires special care and favorable conditions. It has been found that irrigation farming meets the requirements of sugar-beet production better than any other system, and it is in the irrigated districts that we may look for the expansion of the beet-sugar business. Each of our projects should endeavor to secure the establishment within its limits of a beet-sugar factory.

The benefits to the farmer of producing sugar beets are direct and permanent. When a sugar company determines to try out a new field of production there are sent into that field experienced and capable agriculturists who work with the farmers in testing out the growing of beets. If the results of the trials are satisfactory, the new territory is added to the field of operations of the sugar company, and in most cases a new factory is started. With the new factory come permanent agriculturists, called field men, who spend their time with the farmers advising and helping with the field crops of all kinds. One of the first things to be done is the establishment of a good crop rotation, which is necessary if beet growing is to be successful. From this enforced crop rotation come the principal profits to the farmer. The intensive cultivation required by the beets makes not only for heavy yield of beets but for increases in the yields of crops following the beets. Increases of from 10 to 50 per cent in yields of grain following beets are common.

Raising sugar beets and keeping live stock go hand in hand. The beet tops left on the ground after beet harvest are worth from \$2.50 to \$5 per acre, make a splendid feed for sheep or cows, and are particularly profitable in starting sheep on feed. In some sections the tops are placed in silo and used to add succulence to the live-stock ration throughout the winter. The sugar factories have by-products called pulp and sirup, which are valuable additions to rations and will assist in the fattening of aged animals where dry feed would prove a failure. The manure secured through stock feeding is the best possible fertilizer for beet fields, and thus we find that these important lines of farm work help each other in all respects.

The raising of sugar beets creates a demand for labor on the farm far in excess of that required for ordinary farming. This labor is usually contracted for at fixed rates per acre of beets, and the people engaged in this work seldom take up other lines. This makes them available year after year, and they may be spared from the beet work in seasons of other rush work, such as hay harvest and grain harvest and also for the care of live stock in winter.

Sugar companies contract in the spring for the fall delivery of beets, the price is fixed in advance, and the farmer knows when he seeds his crop the price per ton he will receive for his beets. The farmer is thereby enabled to make business arrangements with merchants and banks with reasonable certainty that he will meet his financial obligations on time.

The business man knows the advantage of operating in a section where high-priced farm products are raised. A crop of beets is worth from \$60 to \$100 per acre, and this makes a great increase in business over what may be expected from crops worth from \$10 to \$50 per acre, as is the case with ordinary farming. The great increase in the number of people on the farms makes a corresponding increase in the home market for everything produced.

In looking into the history of every community where a beet-sugar factory has been established it is found that a rapid increase in the value of land has followed without fail, and the values have remained high. This industry gives a permanent high value to farm lands, which is a feature farmers will not overlook.

The handling of the heavy tonnage of beets over country roads makes good roads necessary. Some farmers will complain of the cost of building good roads where crop returns are poor, but no farmer who handles sugar beets will want anything but good roads.

None of our projects can afford to overlook the opportunity of getting a beet-sugar factory within the project limits.

SUGAR-BEET SPECIALS.

Growing sugar beets *promotes*:

1. Thorough cultivation, which means better soil conditions and fewer weeds.
2. Crop rotation, which means better farming methods and even distribution of labor.
3. Dairying and live-stock handling, which mean better incomes and maintenance of soil fertility.

Growing sugar beets *decreases*:

1. Danger of crop losses from hail or frost; the sugar beet is a hardy plant.
2. The cost of crops that follow; the digging of beets is as good as deep fall plowing.

3. Financial risk of changes in crop markets; the price of beets is known before they are planted.

Growing of sugar beets *increases*:

1. By 25 to 50 per cent the yields of crops following beets.

2. The market for forage through local increases in live-stock business.

3. The price per acre of land and makes the price stable.

4. The population of country and town, making bigger and better local markets.

5. The supply of local, year-around available labor.

IT PAYS TO GROW SUGAR BEETS.

The tops and crowns of sugar beets are equal to an average cutting of alfalfa with a grain ration added in making beef and mutton.

An acre of beets will furnish 7 to 15 tons of tops for ensilage.

The beet pulp and molasses by-products from the sugar factory make excellent and cheap feed for stock. Pulp for old ewes and old cows and molasses for hogs and horses.

Sugar companies keep expert agriculturists in the field to help the farmers, without cost to the farmer.

Sugar beets make a paying crop for young orchards.

Keep one-fourth of your farm in sugar beets and after your crop rotation gets to working you will harvest as much from the remaining three-fourths as you do now from your entire farm.

Most of the Government irrigation projects are well fitted by soil, water, and climate for successful beet growing.

Sugar beets are a good crop for small farms.

Sugar-beet districts are prosperous farming communities.

It is easy for a beet grower to get credit at the bank.

Handling of sugar beets requires good horses and good roads, and both are found in sugar districts.

LIVE STOCK.

FEED SOME STOCK ON THE FARM.

Notwithstanding the fact that the subject of feeding stock on the farm has been often mentioned by me in farmers' meetings, I find on my rounds of the projects so much need for the irrigation farmers to take up stock feeding that I feel I must say something more on the subject, particularly since I find that some of our settlers are succumbing to the lures of the advertisers of commercial fertilizers—those mysterious “patent medicines” which are cure-alls for the ills of the soil.

Farmers should bear in mind that stock feeding on the farm has two highly important advantages over straight cropping of the soil, viz. it furnishes a ready market for the crops produced on the farm and it furnishes a means of building up and maintaining the fertility of the soil.

I recently read a report of an important meeting of banking men and one of the speakers, I think a banker from Minnesota, stated that in his community the only farmer who can get a loan of money at the bank is the “farmer who habitually has cow manure on his boots.” There is more to that than a catchy phrase. It represents realization by the bankers and business men that the farmer who does not keep stock of some kind is a poor financial risk and the farmer who feeds his field crops to live stock is a good financial risk. The farmer who sells his crops from the field or bin and then purchases commercial fertilizer to “tune up” his soil is rapidly putting his balance on the wrong side of the ledger. The farmer who markets his crops through live stock or live-stock products and then cares for and places the manure on his land is the farmer who is getting ahead.

No matter how small the farm some kind of stock should be fed. If the land is too high-priced to profitably breed and raise stock in every community, cattle, sheep, hogs, or even chickens or turkeys can be bought as feeders at market prices and a good profit made by putting them in shape for market.

In Germany farmers will purchase and feed steers at what would appear to be \$10 or \$20 loss per head, but these farmers claim that

they make profits of from \$15 to \$30 per head when proper credit is given for the fertilizer produced.

On every farm there is a certain amount of pasture and forage which can be utilized only by feeding stock. The refuse from gardens and orchards will furnish considerable hog feed if properly utilized. What is left on grain fields after harvest will go a long way toward fattening several hogs. The pasture along canal banks and in fence corners of an ordinary 40-acre farm will keep three milch cows during the summer months. Chickens and turkeys will rustle their feed from what would otherwise be waste.

The work horses on the farm might just as well be good brood mares and each raise a colt every year. This can be arranged so as not to interfere with the regular farm work, and within a short time the farmer will have a team of horses to sell each year at good prices.

If the farm is fairly large and several hundred tons of alfalfa forage are produced, sheep or cattle bought as feeders in September or October and fed 100 to 150 days and then sent to market in good shape will make a nice profit.

If the farm is small, a few acres can be put into root crops and the roots fed to good advantage, particularly if grain is scarce or high priced. Our friends in Canada took to the Fat Stock Show in Chicago stock that had been fattened on root crops and forage, without any grain whatever, and they carried off many of the prizes.

If there is on the farm land available for permanent pasture, such a pasture should be seeded. Elsewhere in these pages you will find an item giving a good mixture of grasses for permanent pasture on bench lands under irrigation.

The farmer by feeding his crops to live stock can make his farm produce the highest-priced products on the American market—beef, mutton, pork, butter, and eggs—and he can rest assured he is building up his soil while he is securing the maximum returns for his labor and investment.

COOPERATIVE OR COMMUNITY BREEDING AND PRODUCTION.

Cooperation between farmers in the same community in selecting and following standard lines of crop and live-stock production is not a new idea, but it is a good idea that is being overlooked on most of the Government irrigation projects.

We find in certain sections of the country where the farmers have banded together and specialized on some crop or breed of live stock that they have by careful methods in production and good business in advertising and selling their products made both their products and locality widely and well known.

Some sections of our country are peculiarly adapted to growing certain crops such as potatoes or melons. By forming associations

and agreeing upon a particular potato or melon that produces best and sells most advantageously the farmers can create a steady and profitable source of income.

The same is true in the apple or citrus fruit districts. It has proven best for all concerned to produce a standard fruit so that the individual crops may be assembled in carload lots or trainload lots of a standard and desirable variety that finds a ready sale at the least expense to the producer.

Some districts are well adapted to producing milling varieties of wheat and others do best with the soft or feeding varieties. By associating and agreeing to produce a certain variety of wheat, or other grain crop, the individual farmers can assemble their crops into large shipments which can be handled at the minimum expense and secure the maximum price.

It has long been recognized that it is best to have a standard breed of dairy cattle in a community. This permits upbuilding the herds by the infusion of new and better blood at the smallest expense to the individual dairyman. The products from this standard breed of dairy cows are practically uniform and admit of uniform advertising, and they secure a uniformly good market.

It is admitted that a carload or trainload of hogs of the same breed and color will by reason of their uniform appearance and condition bring prices in advance of a heterogeneous bunch of hogs. The idea of economy and good results in improving the breed where a standard breed is adopted is true of hogs as well as of cattle.

The same principles are true in poultry. Shipments of eggs of similar color, size, and shape and shipments of dressed poultry or live poultry of the same color, size, and shape will find the best market and bring the best prices.

So, I say to the farmers on the projects, get together, form associations to promote crop and live-stock production. Agree upon and adopt as standard breeds of dairy cows, beef cattle, sheep, hogs, and poultry the particular breeds or strains that do well and sell best on the nearest good market.

Take the varieties of fruit, grain, and other products that are especially adapted to the project, confine your work to the varieties selected by your association, and advertise and improve those varieties.

Some of the advantages of cooperative breeding, which means standardizing the live stock of a community, are:

Improvements by additions of new blood may be made more quickly and with less expense to individuals.

Care and feeding of standard breeds may be standardized.

Cooperative breeding makes possible cooperative marketing.

Production of standard breeds brings the purchaser to the producer.

Standard breeds secure the maximum prices that any standard article earns.

By cooperative effort it is possible for a community to secure high-grade sires which would be too expensive for one or two or three individuals, and when a good sire is secured it could be utilized throughout its life of usefulness. On the other hand, if an undesirable sire is purchased, it may be eliminated without serious loss to any individual. If an individual brings an undesirable sire into a community he is often forced by financial considerations to continue the use of the undesirable sire in the community, to the unending detriment to live-stock interests in that community.

It is well known that different breeds of live stock require varying methods of care and feeding. Where the breeds for a community are standardized, the best methods of care and feeding may be determined for that locality and greater returns realized from feed and labor.

The advantages of cooperative breeding as an aid to cooperative marketing are obvious. Cooperative marketing will not make great headway until cooperative breeding makes it possible.

Communities which have not established reputations for standard production are forced to market their surplus in hit-or-miss manner, carrying their live stock to the buying centers, where they are at the mercy of the buyers. Where communities have established standards, buyers are glad to come to the producer, and the producer may reject unsatisfactory bids without fear of loss.

Go into any marketing center and inquire into the prices of anything on the market. You will find that the standard products carry the maximum prices. Standard products are the first to advance in price and the last to slump in price. It makes no difference whether the product be poultry, dairy product, beef, mutton, or pork. the producer of the standard product receives the reward to which he is entitled—maximum prices.

Consider the success attained by the community of Frenchmen who have made the Percheron horse favorably known throughout the world. The name Jersey is known where cows are milked, and yet the name of that breed originated on a small island where people believed in standardization. Until Belgium got into the limelight through the misfortunes of war that country was most widely known as the home of a standard breed of draft horses. The Hereford, the Shorthorn, the Ayreshire, the Holstein, and other famous breeds of cattle were made possible through cooperation in communities bent on producing something worth while.

It is recognized that to bring about this cooperation in community production some of the farmers who are now successfully handling certain good lines of live stock and general products will have to lay aside their personal likes and dislikes and join with the majority in producing other good breeds and varieties. The farmer who has the good of his community in mind—and this really means his personal advancement and interest—will be willing to join the association in its efforts to promote the general welfare. When this is done co-operative buying and selling, advertising, and breeding can be practiced to the great common good of the community.

BETTER CARE AND MORE LIVE STOCK.

Just in the same measure that extra care in handling field crops means an increased harvest, so special care in handling live stock means more meat food for our people.

The mortality among young pigs, calves, colts, and lambs—due directly to lack of care—runs into losses amounting to millions of dollars yearly. There is no doubt but that our farmers could readily save on an average of one more pig in each litter than they now save. Think what that means for the entire country—an increase of at least 10,000,000 hogs. The increase in other classes of stock would not, of course, be so great, but results of special care would be immensely beneficial when the entire country is considered.

The average farmer raises but one litter of pigs from a brood sow each year. Probably a half or a third of the total number of brood sows would readily produce and care for a second litter each year, particularly if they are given the care and nourishing feed necessary to make a two-litter per year program successful.

It is likely the average farm has about 50 chickens when winter sets in. If each farm wife would this year manage to have a couple of extra broods—say 25 chicks—hatched and saved the total increase in our poultry would mean a tremendous help in the food situation.

The present situation does not demand that a few people make great efforts or sacrifices; what is needed is a little extra effort by each and every person. The production of live stock is the business of the farmer, and in this work he should do his bit to help the general situation.

PICK YOUR BREEDERS.

Improvements in both vegetable and animal life are made through careful selection and segregation of the strains or types to be perpetuated.

The corn belt in this country has gradually widened and lengthened, not by reason of changes in climate, but by means of breeding various

strains of corn, some of which would do well in the warm sections of the country, and others of which would mature in the short-season sections farther north. Millions of acres of semiarid lands in the Great Plains area of this country are being made to support homes through the selection of crops which will thrive and mature in these districts of scant rainfall.

The existence to-day of the many breeds of live stock suited to the varying needs of man is due to the untiring work of live-stock breeders, who make it the life work of not only one but many generations of a family to bring about excellence in certain types of live stock. When we consider the great amount of care involved in the fixing of the standard types of live stock the indifferent attitude of many farmers toward the breeding up of farm live stock seems nothing short of criminal.

Reasonable care in the selection of breeding stock on the farm would work advantages which, considered for the entire country, would add millions of dollars annually to the live-stock wealth of this country. For example, a farmer has two brood sows; one produces five good pigs and the other nine. It has been demonstrated that the ability of sows to produce large litters is transmitted to their offspring. This fact should lead the farmer to pick his breeding stock from the litter of nine rather than from the litter of five.

To breed mares to standard sires might cost a day's time and \$5 more than to breed to some scrub sire conveniently located. It is a good investment of time and money, however, to use the standard sire, as the colt when 2 years old would easily be worth \$50 more than that secured from a scrub sire, and if the colt should be a mare the value through its offspring is increased indefinitely year after year. So it is with all classes of live stock. The perpetuation of scrub live stock should be considered a public nuisance where it is possible to improve the breeds. If you do not possess live stock that is worth perpetuating you should at once get a start of the right kind. Know the characteristics of the live stock you possess; know which mare, cow, ewe, or sow produces in its young qualities that make profitable farm animals. Get rid of the ones that are not profitable and which produce unprofitable young. Do not make out of your farm a home for decrepit and inefficient live stock. Pick your breeders.

FEEDING AND BREEDING.

Many a farmer has read the glowing accounts of profits to be made in handling pure-bred live stock until he has been induced to invest in some pure-bred animals. After a time he comes to the conclusion that there is no advantage in pure-bred stock. In the majority of

such cases the fault does not lie with the pure-bred stock nor with the good intentions of the farmer, but mostly with the boomers of pure-bred stock in that they failed to place sufficient emphasis on the fact that pure-bred stock is specialized along various lines such as beef cattle, dairy cattle, draft horses, road horses, bacon hogs, and lard hogs, and each type of animal requires care and feeding in keeping with the utility of that animal. For example, we can not expect good results by feeding dairy cows beef-cattle rations, nor by feeding draft horses rations suited for road horses. The pure-bred animal is a specialized piece of machinery and will perform properly only when given the proper materials to work with. Experience shows us that there is much in pure-bred animals, but it takes feeding and care to bring it out. A man who thoroughly understands handling live stock can take grade stock and secure better results than can the inefficient stockman with pure-bred stock.

The beginner with live stock is very apt to purchase high-priced stock and expect superior results therefrom before he has any practical knowledge of caring for any kind of stock.

Do not get the idea that because live stock is kept on every farm every farmer is getting the best results possible out of that live stock or that every farmer is making money with live stock. Too many farmers give brood sows rations that should be fed only to hogs being fattened for market, and many farmers give to milch cows rations more suited to a goat.

The phenomenal records of milk and butter fat production by cows which we read of in all the farm papers are not due entirely to the fact that these cows are pure bred. As a matter of fact most of the record breakers are pure-bred cows, cows bred to produce milk and butter fat; we would not expect a Hereford cow to break any milk-production records. But a knowledge of the special care given these record-breaking cows, what they are fed, and the frequency with which they are fed and milked makes us realize that there is importance in feeding as well as in breeding.

The best results in handling live stock may be had by handling stock bred and specialized along certain lines, providing the stockman understands what the stock can best accomplish, and feeds and cares for the stock accordingly. Do not condemn pure-bred live stock if you have failed to furnish rations which that particular kind of stock is best adapted to utilize. The successful live-stock man is not merely an authority on breeding or on feeding alone. Success with live stock follows a combination of good judgment in feeding and breeding.

WINTER SHELTER FOR LIVE STOCK.

Success with live stock depends upon careful attention to three cardinal principles, viz, breed, care, and feed. These three essen-

tials are dependent each on the others, and no amount of attention to care and feeding will make up for faulty breeding, and no amount of attention to breeding will correct the evils resulting from poor care or poor feeding.

At this time the leaders in live-stock work appear to be putting particular stress upon breeding and feeding, and it is opportune to say a few words on the subject of care of live stock, with particular reference to winter shelters. I will not treat on this subject from the humane standpoint, though much might be pertinently said along that line. The economic phase of this subject should be sufficient argument to induce the man who has live stock to provide proper shelter for his stock and protect them from the rigors of winter weather.

To living beings feed is fuel. The food taken by animals provides, first, for the growth or upkeep of the body. Undue exposure tears down the structure of the body, and an excess of food is necessary to combat this tearing-down process. Food taken by animals in excess of the amount necessary to keep the body in condition is manufactured by the animal into fat or milk. It is obvious that in order to get the best results from the feed given to live stock we must keep the live stock in such shelters as will make it unnecessary for the stock to use all the feed they receive in keeping their bodies normal; we must make it possible for them to manufacture growth, fat, and milk out of a portion of the feed, for the reason that growth, fat, or milk represent the profits in keeping live stock.

The essentials for proper winter shelter for live stock are fresh air, light, dry and warm beds, and freedom from drafts. It is not necessary to spend thousands of dollars to provide these essentials. It is the choice of locations for shelters and the common sense used in the construction of the shelters that make or mar their efficiency. The straw-thatched shed is often more efficient than the expensive building.

Clean air is as important to animals as it is to people. To shut any animal in a building in such manner that there is no supply of fresh air and no escape for foul air is to surely bring upon the animals exposure to dangerous diseases and to provide certain transmission of these diseases from one animal to another. Foul air always carries disease. Provide for bringing in fresh air and the escape of foul air.

Light—sunlight—is the peer of all disinfectants and a purifier of air. At the present prices at which glass may be had it is about as cheap as other building material. There is no reason for making a dark cell out of your barn. Turn on the sunlight.

Instead of leaving the straw stack to rot in the field, put the straw through the barns, sheds, and feed lots as bedding for the stock. An

animal will not through choice make its bed on wet manure. To the discredit of some farmers it may be said that they shut horses, cows, hogs, and sheep in shelters where the floors are damp and where no straw or litter is provided for bedding. Still these animals are expected to return a profit to the owner. An animal to be profitable must first be comfortable. Make real beds for your stock. They will appreciate it and you will sleep better on stormy nights if you know that the animals that have come into your care are not suffering through fault of yours.

A thing that is dreaded by people as a plague in wintertime is a draft. Reams and reams have been written by health authorities on the dangers of drafts. Animals are just as susceptible to the dangers of drafts as are people. You can without extra cost provide shelters in which the stock will get fresh air without being subject to drafts.

Do not go too far in sheltering live stock. If you unduly pamper the animals you lower their bodily strength and their vigor. Pay particular attention to the essentials—fresh air, light, dry and warm beds, and freedom from drafts—and this care in connection with attention to breeding and feeding will yield profits.

BEDDING.

When the near winter season is upon us and the chill in the air makes a man reach for the woolly blankets about 2 a. m., we should have a thought for the comfort of our live stock.

We many have the finest of stock barns and shelters, but unless we do a little upholstering of the places where the stock must sleep we have not provided one of the things most important to live-stock comfort.

It is more than likely that somewhere on the place a straw stack is slowly rotting down to be eventually scattered over the fields. The quickest and best route for a straw stack to take to the fields is via the floor of the barns and shelters. Plenty of good clean straw bedding, frequently renewed, will save many a dollar on your feed bill. If you do not keep your stock warm from the outside with bedding, you will have to do it from the inside with feed.

Straw bedding serves the additional purpose of absorbing the liquid manures which would otherwise run to waste and worse by making a filthy underfooting for the stock. Straw thus mixed with manure more quickly rots and adds value to the manure.

It takes more than a warm bed to make a man sleep comfortably on cold winter nights. An easy conscience will help wonderfully, and to know that all the farm animals are bedded down as snug as you can make them will do much to ease the conscience.

WINTER LOSSES.

We have all heard the old query, "If a frog in a 20-foot well climbs up 4 feet each day and slips back 3 feet each night, how long will it take him to get out?" Many a farmer is up against the same question in producing live stock. If, through the use of plenty of grass and other succulent feeds, he makes a cow weigh 1,000 pounds in the fall and she shrinks back to 800 pounds before spring, how much does he realize on what the cow eats? A little thinking along this line will induce the wise farmer to stop up the cracks in his barns and sheds, to haul in plenty of straw for bedding, and make sure of a good supply of roughage and other feeds necessary to hold on the stock the flesh they have gained during the summer months.

Every pound of animal flesh is worth its market price at the close of the grass season and if any of this flesh is lost during the winter it must be charged to the loss account and the animal started out again in the spring in a weakened condition.

Hold your stock in good condition through the winter.

SHADE.

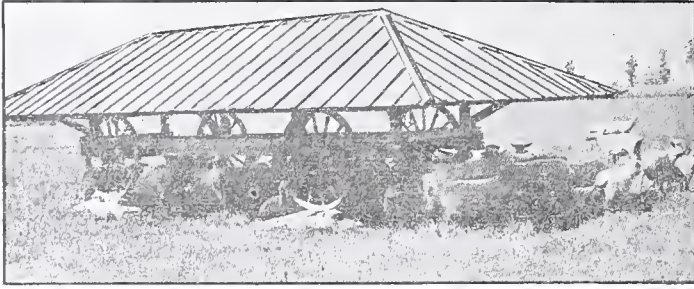
Don't forget that the only profitable animal is a comfortable animal. No animal is comfortable during the hottest months of the year unless it has access to shade. Farm animals which must go unprotected in cold, stormy weather have my sympathy, but no more than those that have to spend the entire day exposed to the scorching sun. Fortunate is the farmer who has trees to furnish shade for his live stock; trees make the best shade. If no trees are available, shade may be provided by the erection of shedlike structures, open on all sides to allow free passage of air. The roofs may be made of boards, brush, or straw. If different kinds of stock are kept in one pasture or lot, some sheds not more than 4 to 5 feet high should be provided for the hogs, sheep, colts, or calves to insure that they will not be driven out into the sun by the larger animals. Man in self-pity has created the hat, the parasol, has put sunshades on wagons, buggies, automobiles, and on some of the implements used in the fields; he has access to the shade of houses and other buildings, while the live stock, the source of much of his buying power, is too often left unprotected.

Intense heat of the sun reduces the vitality of live stock, and this lost vitality must be regained at the expense of the farmer; there is an economic as well as a humane side to this question. If you keep live stock, keep them comfortable; provide some shade.

WHEELED STOCK SHELTER.

Winter or summer stock needs shelter from snow, rain, or sun. Sheep and hogs particularly need shelter from the hot sun, and a

movable shelter is a convenience. The Agricultural Digest has brought to light a shelter on wheels which appeals to me as being practical, and an illustration is here reproduced. The blocks used to



elevate the wheels are an important item. In some of the more windy sections it would be necessary to provide posts or guy wires to prevent the shelter being overturned or blown from its blocks.

WATER FOR LIVE STOCK.

On the subject of live stock there is writing without end. Practically every phase of live-stock feeding and breeding is being presented to the public through the multitude of present-day newspapers, periodicals, and books. The only phase of this big subject which appears to be overlooked at this time is the importance of plenty of good water for live stock.

On averaging our farm animals we find that out of each 100 pounds of live weight 49 pounds is water. This should indicate to all the important function of water in the well-being of the farm animal.

If an animal is provided with good water in accordance with its natural needs, it will, obviously, make the best practicable use of the dry feed furnished it. It has been found by practical tests that animals endeavor to maintain a reasonable balance as between the amount of dry feed and the amount of water taken into their bodies. For each 100 pounds of dry feed it is necessary for the animal to have a specified amount of water in order to make the best use of the dry feed. The proportion of water to dry feed varies, of course, with the different animals.

The ideal way is to have plenty of good clean water before the stock at all times. Unfortunately this is impracticable. In the Northern States there are the freezing temperatures to contend with. Icy water is not good for stock and it is difficult to keep reasonably warm water before them. When an animal takes ice-cold water into its body, it is necessary to bring this water to a proper body temperature before it can be utilized by the body. This means a sacrifice of warmth and on this account many animals prefer to go thirsty rather than take a proper amount of water when the water is cold. This is par-

ticularly true of stock which is not well sheltered. It is worth going to considerable expense and labor to supply stock with reasonably warm water in cold weather. It will enable you to get larger returns from your high-priced hay and grain.

An unsatisfactory condition met with in some States is the use of stagnant ponds and reservoirs for watering stock. Stagnant and unclean water is no more fit for live stock than it is fit for people. You need not expect healthy and profitable live stock if you force that stock to drink unclean water. When an animal drinks impure water, the impurities must be removed by the digestive organs of the animal before the water can be used to advantage. Don't make filters out of your stock. You would not, of course, put sand in the axle grease you use on your farm wagon, but you are doing something just as unwise when you force your stock to drink unclean water. Impurities in water are to an animal's digestive organs what sand is to the bearings of your farm wagon.

A good-sized book could be written on the subject of water for live stock. Space here will not permit mention of all the important phases of this subject. One caution may well be added, however. Water is a great conveyer of animal diseases. Hog cholera in particular is carried from one farm to another by streams and irrigation ditches. Horse diseases are transmitted through public watering places. Cattle diseases are spread through the indiscriminate use of open watering holes. Be sure that your live stock is not exposed to disease in any preventable manner.

BLOAT.

Throughout the alfalfa-growing section—and this includes all our reclamation projects—there is much complaint of serious cases of bloat caused by grazing alfalfa. Some losses of stock have occurred, and it is probable that some of our farmers are not making full use of their alfalfa pasture through fear of losses of stock from bloat. A clear understanding of the causes, preventives, and cures of bloat will remove much of the danger. Alfalfa pasture is one of our greatest assets, and we should make the fullest possible use of it, taking the simple precautions necessary to prevent loss from bloat.

Bloat is the result of fermentation of food in the stomach of the animal; this fermentation causes gases, which distend the abdominal cavities. Alfalfa contains certain elements which if taken in considerable quantities under certain conditions ferment quickly. Careful observation of alfalfa grazing leads to the conclusion that practically all cases of alfalfa bloat are caused by the following conditions: Turning hungry stock on young alfalfa; grazing alfalfa when it is wet with dew or rain; free grazing of alfalfa when it is making rapid

growth; grazing alfalfa when it is first frosted or when it is freezing and thawing.

Many preventives of bloat have been given publicity. Some of them are fully successful and some partially so. The busy farmer does not have time to keep close watch of his grazing stock, and the most simple preventives are the most useful. One of the most practical preventives is the plan common in some of the Southern States of seeding into the alfalfa pastures a crop of barley and grazing the combined alfalfa-barley crop, which does not cause bloat. This plan may be changed to suit various localities and other crops which do not cause bloat may be seeded in the alfalfa pastures. Another good plan is to give the stock a good feed of cured alfalfa hay before turning on the pasture each day. The stock are less liable to gorge themselves if this plan is followed. Some advocate keeping in the alfalfa pasture a rack filled with cured alfalfa. It is not believed, however, that this plan is as satisfactory as that of feeding the cured alfalfa before turning the stock into the pasture. When the number of animals to be grazed is limited, a successful plan is to fit into the mouth of each animal a large bridle bit or a wooden bit made for the purpose. This prevents the stock from eating too fast and decreases the danger of an accumulation of gases.

It has been found that it is practically impossible to prevent bloat entirely. It is necessary, therefore, that every farmer have at hand at least one reliable remedy for bloat.

I find it a common practice to exercise animals that are suffering from bloat. In my opinion this is a serious mistake. I know of a number of heavy losses from exercising cattle and sheep while they were suffering from bloat. Let the animals remain as quiet as is possible. It is generally understood that the suffering animals may be afforded relief if they are stood so their fore feet are considerably higher than their hind feet.

As has been stated, bloat is caused by fermentation of foods in the stomach, and cures for bloat must act internally in such manner as to prevent this fermentation, and this internal treatment should be supplemented by some treatment which will aid the escape of the gases which have formed in the stomach.

Following are simple remedies, given in quantities which are doses suitable for full-grown cattle, each remedy is to be given as a drench:

- (1) One to 2 ounces of turpentine well shaken into 2 quarts of milk.
- (2) One ounce of aromatic spirits of ammonia in 1 quart of water.
- (3) One-half ounce of chloride of lime in 1 pint of water.
- (4) One pint of melted lard placed well back in the throat.
- (5) One and one-third ounces of formalin in 1 quart of water.

(6) One pound of baking soda and three heaping tablespoonfuls of ginger in 1 to 2 quarts of water.

After giving any one of the above-named remedies, it is well to place a wooden bit or block of wood in the animal's mouth to keep it open that the gases may escape without hindrance. Some recommend that about 3 feet of $\frac{1}{2}$ -inch hose be worked down a cow's throat to assist the gases to escape.

Some cases of bloat are, when discovered, too much developed and too serious to permit attempt at relief through drenches. In these cases the one sure cure is the use of the trocar and cannula. This is a simple and inexpensive instrument consisting of the trocar—a sharpened steel “sticker”—which fits inside a steel tube called the cannula. The entire instrument is about as thick as a lead pencil and from 4 to 7 inches in length. This instrument should be kept well oiled and clean.

In tapping a bloated cow the instrument is to be inserted through the hide on the left side at a point about half way between the last rib and the point of the hip. Use care not to make the puncture too high. Point the trocar in the general direction of the right shoulder and with one blow drive the instrument in to the hilt. Then pull out the trocar, leaving the cannula inserted, and the gases escape direct from the animal's stomach through this tube. Don't be afraid of killing the cow. Just bear in mind that the stomach punctured is about the size of a wash tub and no vital organs are touched. Let the cannula remain in place an hour or so, keeping watch on it that it does not become clogged. As soon as you have punctured the animal's stomach, give one of the drenches described in this article in order that the fermentation in the stomach may be stopped. When you remove the cannula from the puncture rub a little tar or tincture of iodine over the wound and no trouble will result.

By all means utilize your alfalfa pasture. With ordinary care you will lose no stock from bloat.

SHEEP.

SHEEP ON THE IRRIGATED FARM.

So much is now being written on the subject of sheep on the farm that it is practically impossible to bring forward anything new and valuable on the subject.

The American people seem suddenly to have realized the truth of what has been preached to them for years—we need more wool and mutton. They also realize that the old system of sheep handling—that of running immense bands on the range the year round—has been broken up, due to settlement of the ranges by farmers. The main source of supply of wool and mutton must therefore be the farm flock. The handling of sheep in small farm flocks has had great impetus of late, but the success of the farmers in this work has been mixed with failures. The success of the farmer is in proportion to his interest in and liking for the sheep.

It takes little capital to start in a small way with sheep. A few head of ewes are sufficient to give the inexperienced farmer the training he needs, and the flock may be increased as experience is gained.

The buildings and equipment necessary for a few sheep are also inexpensive. A straw-thatched shed, closed on three sides and located on dry ground, is very acceptable to the sheep. Their welfare demands shelter from snow, rain, and winds.

On the irrigated farm a permanent mixed-grass pasture, so arranged that it may be divided and the sheep confined to one part while the other part is being irrigated, will be found very profitable and convenient. Alfalfa may be used for sheep pasture if the farmer is willing to give the time and care necessary to prevent loss of sheep from bloat.

For the beginner I recommend the purchase of grade ewes in the fall, bred ewes being secured, if possible, to get them bred to full-blooded rams. I hear some one say: "Why not start with full-blood ewes?" Well, in recommending grade ewes I am speaking from experience. To handle full-blood sheep as they should be handled requires experience, and it is just as well for the farmer to practice

on something not quite so expensive. If the man is a real sheepman, he will work into the full-blooded business quickly enough.

A breeding ewe should be of good size, smooth bodied, with a fairly heavy fleece. The ewe should be expected to pay for her keep with her fleece. Ewes over 2 years old—say, 2 to 4 years old—should be selected. Ewes lambing for the first time give much trouble in various ways; they may disown their lambs, fail to produce milk, or be shy and hard to handle. Usually the older ewes produce more lambs. Farmers have not fully appreciated the value of breeding ewes. A ewe which will pay for her keep with her fleece and produce a \$10 lamb surely should be worth \$20. Heretofore the ewe has done well to bring the price of her lamb. The farmer should look upon the ewes as having special value, also individuality, just as mares, cows, and sows.

If the ewes are secured in good condition, as they should be, their principal feed during the winter may be alfalfa hay, with the addition of a little silage or beet pulp—say, 2 pounds per head per day—or a like quantity of roots. The average gestation period is about 150 days. About 30 days before lambing time a small amount of grain may be gradually introduced into the ration, about half a pound per day being the maximum. A few days before lambing the grain should be discontinued and not fed again until about 3 days after lambing. This will prevent trouble like milk fever and various bag ailments. If the milk flow is not sufficient for the lambs, the grain may be increased some over a half pound per day. I have found dried beet pulp beneficial at this stage, fed practically the same as grain.

Lambing time is the trying time for the flockmaster. Then it is that his profits or losses are started. Watch must be kept over the flock day and night during this period. Some of the ewes will need assistance in lambing and some of the lambs will need the shepherd's help to get a start. The ewes and their young should be given individual inclosures for a few days until they become thoroughly acquainted. If part of the ewes have two lambs and part only one, it may be necessary to feed these two classes separately, as the ewes with twins will need more concentrated feed than will those with single lambs.

Castrating and docking the lambs are important for the good of the flock and should not be neglected. Where large numbers are handled it is common to perform both these operations at one time. Due to the great shock, losses occur from such double operations. With a small flock it is not unhandy to perform these operations about a week apart, both being done by the time the lambs are 15 days old. The docking is best done with heated pincers, which simultaneously remove the tail and sear the cut, preventing loss of blood.

At about 2 weeks of age the lambs will begin to eat, and a creep should be provided for them and ground grain placed in troughs where the ewes can not get to it. This will hasten their development. Also, a good plan is to plant rape in rows in an inclosure adjoining the sheep pasture or yard, and when it is 7 or 8 weeks old the lambs may be permitted to creep into it. This will bring them to the fattening period in fine shape.

Quite a book might be written on the subject of sheep feeding, and still there would be much to tell. The best plan is for the farmer to keep his sheep thriving on pasture, forage, and roughage as well as he can without the use of much grain until the time comes to put them on a fattening ration. Then they may be put into pens on a full feed of alfalfa hay, with a grain ration being gradually added. A quarter of a pound of corn per sheep per day, with alfalfa, will put on fat; of wheat or oats, up to half a pound per head per day may be fed.

In these days of high-priced feeds every feeding operation must be conducted with care and judgment. Cleanliness, punctuality, and kindness must be the ruling principles in handling sheep on feed. Sheep will not eat unclean feed or drink dirty water. They are better timekeepers than most alarm clocks and worry if their feed is not forthcoming at the proper time. An animal that is worried or constantly subject to fright will not put on fat. In fact, you must love stock to be successful with them. Take care of them just as you would your best girl, but remember how, before you were married, you would take care that she did not get her feet wet and how you would pull off your coat, loan it to her, and go cold yourself rather than let her be uncomfortable.

There is no reason why every other farm should not have its band of sheep. I say every other one because I realize not all of us would be successful with sheep.

Two years ago I started a band of breeding ewes on Hesper Farm, and in both 1916 and 1917 I have found them satisfactory and profitable. The ewes were a mixed bunch, so far as breeding goes, but they were very good grade ewes for the purpose. The rams were full blooded. In 1916 the returns on about 100 ewes and their increase were sufficient to pay for the ewes and all the expenses of care and feed and leave me the ewes for profit.

For 1917 the account stands about as follows:

CREDIT.

Wool sales -----	\$1, 280. 00	
Lambs sold -----	2, 030. 00	
On hand Nov. 1, 1917, 179 ewes and 3 rams -----	1, 532. 00	
		<hr/> \$4, 842. 00

DEBIT

Nov. 1, 1916, 179 ewes, at \$8-----	\$1, 432. 00
Nov. 1, 1916, 3 rams-----	100. 00
Wintering costs:	
3 months' pasture-----	\$163. 00
3 months' hay-----	273. 00
5 tons dry beet pulp-----	125. 00
	<hr/> 561. 00
Lambing-----	100. 00
Shearing and dipping-----	50. 00
Summer pasture, 182 head, 3 months-----	163. 00
Summer pasture, 382 head, 3 months-----	343. 00
Herdling, 3 months-----	180. 00
	<hr/> \$2, 929. 00
Profit-----	<hr/> 1, 913. 00

An item of expense which properly should be included would be interest on the investment in the ewes for the year, or about \$115. This would still leave a profit of about \$10 per head on the flock of 182. No depreciation is charged on the ewes for the reason that they are worth more November 1, 1917, than they were one year earlier, and they are inventoried at the close of the year at the same price as the cost November 1, 1916.

Due to prevailing high prices, returns run into high figures, but the same proportion of expense and profit would work out if feed, labor, mutton, and wool were priced lower.

I notice a news item in a western farm paper telling that Mr. E. P. Adams, of the Myrtle Point district, Oreg., foresaw good profits in sheep raising 18 months ago and invested in sheep to the amount of \$250. Since then he has sold wool and sheep worth \$693 and still has 70 animals, valued at \$700.

One Illinois man on a little prairie farm cropped to corn, oats, and clover and stocked with a few brood mares, some hogs, and a few sheep has been more than ordinarily successful. His 18 grade Shropshire ewes raised 31 lambs this year. The wether lambs were recently sold on the market at a little over 100 pounds in weight, and 10 of the ewe lambs were sold for breeding purposes to a neighbor at \$20 each. Each of his old ewes produced an income of \$35 in lambs and wool this year.

I notice the following in the California Cultivator of November 10:

"I would not know how to do good farming without sheep," declared George McKerrow, of Wisconsin, one of the best and most widely known sheep breeders of America, on a recent visit to the Food Administration in Washington. "Why?" he continued, "because my sheep use up the wastes of the farm. They clean up the grass, weeds, brush, and gleanings, and in so doing turn into cash what otherwise would be lost." "Sheep," said Mr. McKerrow, "make the most economical gains of any kind of live stock, because they clean up odds and ends."

Nature, or habit, has made some kinds of live stock economical. For example, after a cow and a horse have taken what they will from a pasture the sheep will follow and wax fat. For the good of the pasture this plan is not recommended, but it is stated to indicate a characteristic of the sheep. Economy must be the watchword of the farmer these times, and we may well depend upon the sheep to make economical use of all feeds and not impose unduly upon the time of the farmer, time being also valuable. A point of considerable importance is that sheep will do good work in harvesting field crops in much the same manner as hogs are used in "hogging off" corn and grains. Sheep will pick up shattered grain in stubble fields, dig beets or other roots left in the ground, and, equipped as they are with splendid grinding teeth, they are glad to save the farmer a milling bill. They will eat potato peelings, scraps from the table, or anything similar which has not become dirty.

For the information of those who have not had experience in starting irrigated pastures, which are so valuable in handling sheep, the following are permanent pasture mixtures which have been found satisfactory in experiments made at Government experiment stations:

For a heavy soil, seed the following per acre:

	Pounds.
Smooth brome grass.....	3 to 4
Kentucky blue grass.....	4 to 6
Orchard grass.....	4 to 6
Meadow fescue.....	3 to 4
White clover.....	1 to 2
Alsike clover.....	1 to 2
Total.....	16 to 24

For an ordinary loam soil, seed the following per acre:

	Pounds.
Kentucky blue grass.....	8
Orchard grass.....	5
Smooth brome grass.....	5
Meadow fescue.....	4
Timothy.....	4
White clover.....	2
Total.....	28

For low or poorly drained soils, seed the following per acre:

	Pounds.
Redtop.....	8
Timothy.....	8
Meadow fescue.....	6
Alsike clover.....	4
Total.....	26

If any local pasture grasses not named are available, they may also be included. Sweet clover might be added in some cases.

The foregoing mixtures are suited to the more northern sections of the country. For detailed information as to starting these pastures it would be well to refer to bulletin issued July 26, 1916, by the Department of Agriculture; subject, "Irrigated Pastures for Northern Reclamation Projects."

Other Government bulletins of interest and value to the beginner with sheep are: No. 573, "The Sheep Industry on the Minidoka Reclamation Project"; No. 576, "Breeds of Sheep on the Farm"; No. 810, "Equipment for Farm Sheep Raising"; and No. 840, "Farm Sheep Raising for Beginners."

Quite a number of books dealing with sheep have been put on the market. Two, which I have read and found practical, are "Sheep Farming in America," by Joseph Wing, sold by Sanders Publishing Co., Chicago, Ill.; and "Sheep Management," by Frank Kleinheinz, University of Wisconsin, Madison, Wis.

REASONS FOR KEEPING SHEEP.

Believing that too much can not be said in favor of keeping sheep on the irrigated farm, I think every one of our farmers should give serious consideration to the 30 reasons, as advanced by Mr. H. J. Schnaidt, of Ames, Iowa, for keeping sheep on the farm. These 30 reasons are as follows:

1. The initial investment in foundation stock is small.
2. Expensive buildings are not necessary.
3. Expensive machinery is not required.
4. Less-productive land can be utilized.
5. Sheep will eat and relish almost every class of weeds.
6. By eating "ragwort," the source of "pictou" cattle disease is eliminated.
7. By cleaning out the fence rows sheep destroy the winter protection of many injurious insects.
8. Due to the fineness of the mastication of their food, very few weed seeds are found in sheep droppings.
9. Sheep are of great value in clearing brush land.
10. Sheep are dual-purpose animals.
11. Crop yields are increased by the constant and uniform distribution of rich manure.
12. The excreta of sheep is rich in nitrogen and potassium.
13. Less plant food is removed from the soil by sheep than by grain crops.
14. The cost of maintenance is small.
15. Sheep make profitable use of fodder left in cornfields after corn is harvested.
16. Sheep can be made marketable without grain.
17. Wool and lambs are more easily transported than grain crops.
18. Rapid and frequent monetary returns.
19. Reasonably large percentages of profits under normal conditions.

20. Wool and mutton advanced in price before the war, and a sudden drop in value is not to be expected.
21. Less labor is required on a sheep farm than on a grain farm.
22. Labor on the farm is more evenly distributed throughout the year.
23. Sheep require little care, except during the usual slack periods.
24. Children, as a rule, like sheep, and this is a good time to develop future shepherds.
25. A flock of sheep on the farm furnishes a fresh supply of meat at any time of the year.
26. Because of the comparatively low cost per animal, sheep are more easily improved than most other types of live stock.
27. Sheep are more prolific than horses and cattle.
28. The western sheep ranches are rapidly disappearing, and it is up to the small farmers to make up the deficiency.
29. The population of the United States is increasing, while the number of sheep is steadily decreasing.
30. As a patriotic duty in the present world crisis, we must produce more wool and mutton.

SHEEP FEEDING.

An old recipe for making chicken pie starts with the very important requirement, "First get the chicken." So with sheep feeding there is one all-important preliminary, and that is, first get the feed.

I am a strong advocate of sheep feeding where the farmer has the necessary feed of his own raising. Buying the sheep and buying the feed for them is just plain gambling for a farmer, and it is a game that has brought financial ruin to some of the best-posted sheepmen in the country. If you have raised your own feed, you can go into sheep feeding with small chances of loss and reasonable assurance of financial gain and absolute assurance of the improvement of your land if you make good use of the fertilizer produced by the sheep.

There are many plans of sheep feeding which have been tried out and found satisfactory in different parts of the country. I will outline briefly two plans which are satisfactory in the alfalfa-growing sections where most of the reclamation projects are located. In these semiarid sections most of the sheep feeding is done in the open—that is, without sheds—a windbreak, which may be either a tight fence or a row of trees, being considered sufficient.

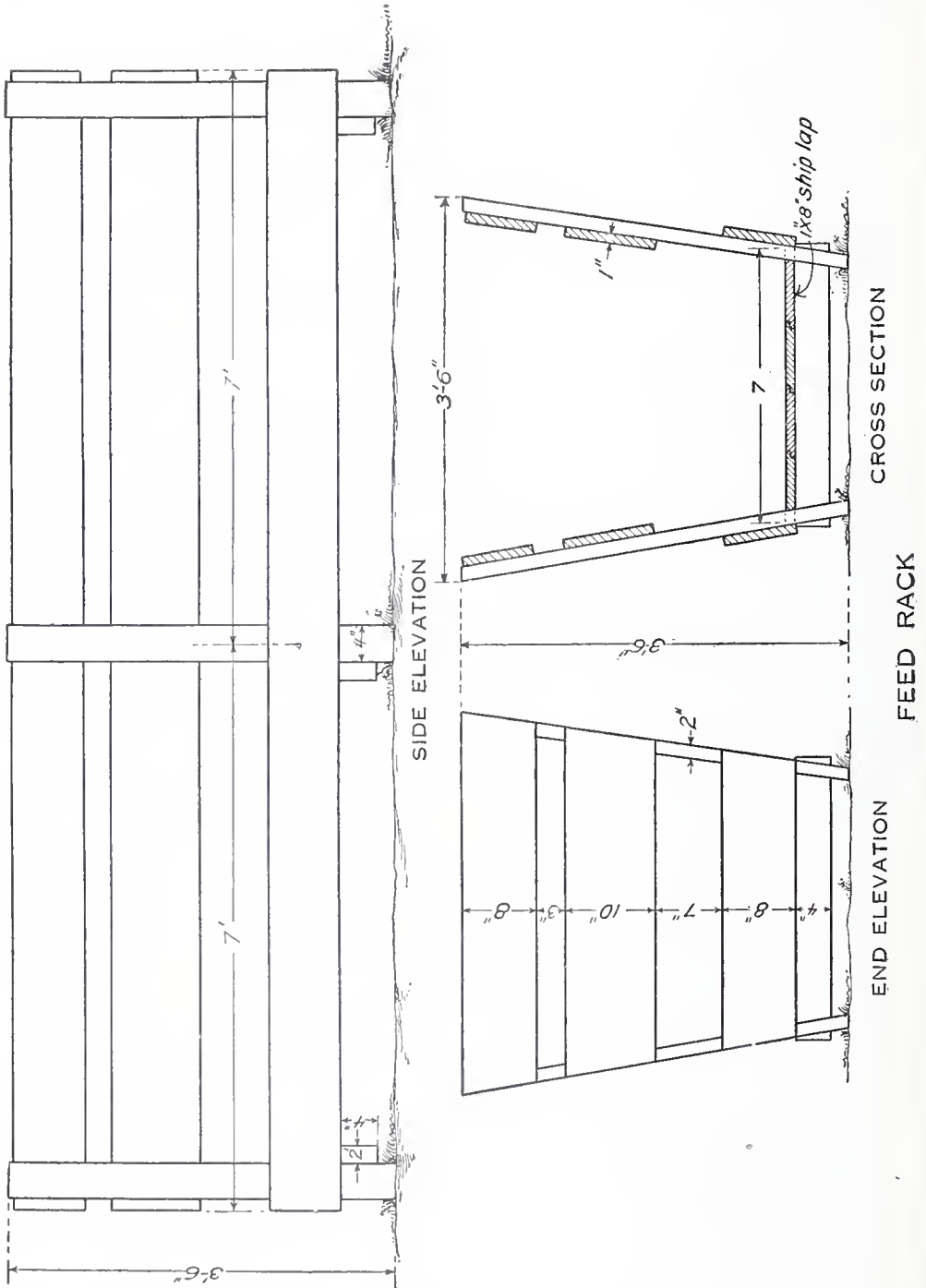
One plan, generally known as the Colorado plan, provides for the feeding of alfalfa from one set of lots or runs and the feeding of grain or concentrates in one grain yard which serves several lots of sheep. For convenience we will assume we are feeding 2,000 sheep. This will require four runs each 250 feet long and 14 feet wide, with hay bunks 14 feet in width between them. All of these runs must communicate direct with the grain-feeding yard, which for convenience may be about 60 to 75 feet wide and about 125 feet long. This yard should contain the equivalent of 20 grain racks each 14

feet in length and so arranged that the sheep may feed from both sides. The accompanying sketch shows an arrangement of the hay and grain yards—this layout may be modified to suit the conditions in each case. The grain racks are best made portable, about 14 feet long, 12 inches wide, and 2 to 4 inches deep, set on legs so the bottom of the trough is 14 to 18 inches off the ground. A 6-inch board should be placed lengthwise about 10 inches above the trough to prevent the sheep standing in or jumping over the trough. The grain ration for 500 head, or one yard of sheep, is placed in the racks and the sheep from one yard turned in. Gates leading from the hay yards should be the full width of the yards to prevent crowding. While these sheep are in the grain yard the hay wagon is driven through the empty run and hay unloaded into the racks on both sides of the wagon. When the sheep have eaten the grain they are returned to the hay run, and the same operation is performed with each of the other three runs of sheep.

The plan of feeding which I favor is that of feeding hay and grain from the same rack. The accompanying sketch shows the construction of the rack used in my feeding. It is simple, easily built, and inexpensive. Under this plan it is best to provide a yard into which the sheep may be turned while the racks are being filled. The racks, which are 14 feet long and a little more than 2 feet wide, will each accommodate about 30 sheep. The racks should be arranged in a double row, so the hay wagon may be driven between them and hay unloaded on both sides. After the racks are filled with hay the grain or concentrate is scattered over the top thereof and the sheep turned in. This plan assures a good distribution of the grain among the sheep, and the hay is eaten with more relish and cleaned up better than where the hay and grain are fed separately.

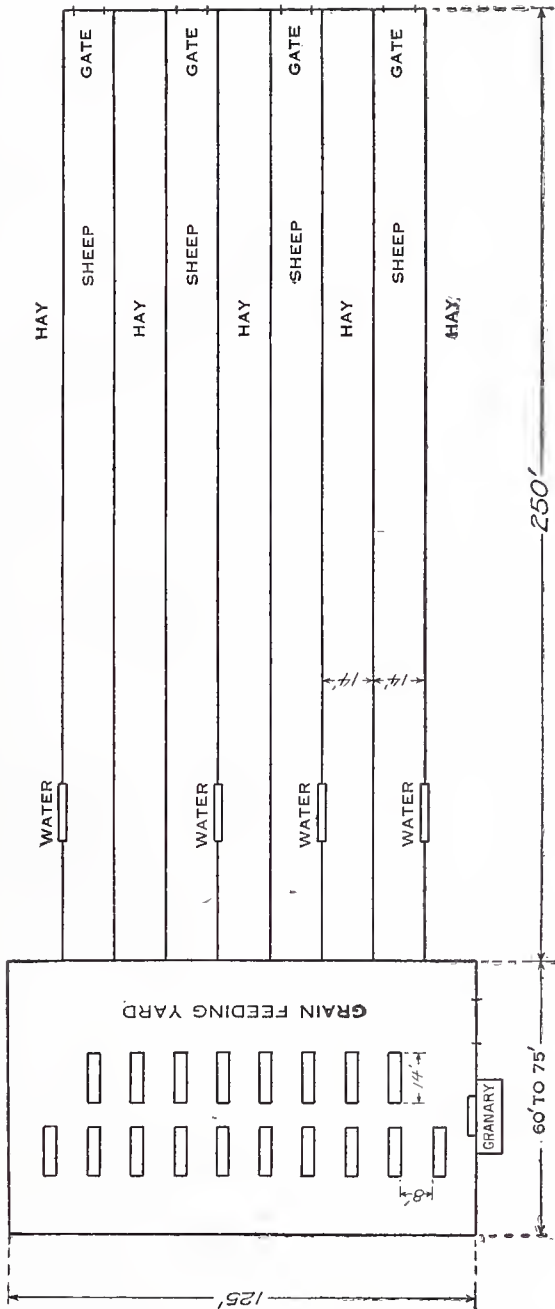
Either of the described plans is satisfactory. There are general conditions which must be observed by the feeder under any plan of feeding. The feed lots must be kept dry; sheep are very particular about where they lie down, and to keep them contented dry bedding must be furnished during wet periods. Unless you are feeding old and broken-mouthed ewes, do not grind the grain for the sheep. Sheep are equipped with the best of grain grinders, and they prefer to do this work themselves. Clean and fresh water must be before the sheep at all times. Do not neglect this. It is considerable work to keep fresh water before the sheep in cold weather, but it must be accomplished. The sheep must be provided with plenty of clean salt. Some feeders roll a barrel into a yard, cut a few staves out of the side of the barrel, and let the sheep help themselves, and this plan is a good one. Keep the sheep quiet. You do not need a dog for yard feeding of sheep, and it is best to have none around. Any ex-

citement among the sheep means dollars lost to you. Keep them quiet. An old country adage, "The eye of the master fattens his cattle," holds good in sheep feeding. Keep close watch on the



sheep; do not let a day pass without closely observing all details. Pay particular attention to the droppings, for by this you can determine to a great extent whether the sheep are thriving. If the

droppings are of a yellowish brown and soft in texture, all is well. If they are hard, dry, and black, the sheep are constipated, and this condition must be relieved at once. A small addition of bran to the



PLAN OF FEED YARD

Side elevation shows location of middle post or upright. End elevation shows method of fastening end boards. All end boards are placed on outside of uprights. The 2 by 4 inch floor supports are placed inside the uprights. Cross section shows method of fastening the side boards and flooring. The bottom side boards are placed outside the uprights, and the middle and top side boards are placed inside the uprights. The floor boards are notched to fit around the uprights, making a grain-tight floor.

grain ration is used with success by some feeders to cure this condition. A sure method is to add flaxseed to the amount of about 2 per cent of the grain ration and continue this during the balance

of the feeding period. The addition of oil meal to the ration has also been found satisfactory in curing constipation.

Every sheep feeder should be provided with a dipping vat and the sheep should be dipped as soon as they are received. It is very difficult to dip sheep properly in cold weather, but it is better to dip them in cold weather than to run the risk of carrying them through the feeding period without their being dipped. If the sheep are taken on in the fall they may be dipped without much trouble at a cost of about 2 cents a head, any of the standard commercial dips being satisfactory.

If the sheep are received before bad weather and there is pasture available, they should be turned into this pasture until it is eaten short or until bad weather sets in. It is well to separate the sheep into the different ages or sizes in putting them into the yards; put those of an age or of a size together. Put all the poorest together so they may be given special care and attention. By so classifying the sheep they may be handled more easily and the small and weak will not be crowded out by the stronger ones.

Be regular in your feeding. The sheep is a good timekeeper and appreciates getting its meals on time. Strict regularity in feeding is profitable.

The amount of feed to give sheep is governed by their breed and age. The coarser and heavier breeds consume more feed than the fine, light breeds. Lambs require less feed than mature sheep. The amount of hay is usually governed by feeding just what they clean up well. When they are first put into the pens they are fed hay only. After two or three weeks on hay only the grain is added, starting only a small amount per sheep—one-tenth of 1 pound per head per day—though with lambs it is well to start with less than this. This grain ration is increased very gradually until the equivalent of 1 pound of wheat per day for a mature sheep is given. This amount with all the alfalfa hay desired should be a full feed for fattening sheep.

SHEEP RATIONS.

Beginning with the ewes after the lambs have been weaned and as soon as the milk flow has ceased, it is important to bring the ewe quickly into a strong, healthy condition in preparation for breeding. It is a serious drain on the ewe to raise one, two, or three lambs, and nutritious food must be available to build her up. One of the most satisfactory feeds at this stage is rape. If rape is seeded early enough to permit it to mature so that the lower leaves and the tips of the upper leaves are turning yellow when it is needed for ewe pasture, it makes an ideal feed. Rape will not cause bloat if care is taken

when first turning sheep on it, and it seems to have a very beneficial effect on the sheep's inner organs. If no rape is available for the ewes, then other pasture, with the addition of a small amount of grain daily, will be satisfactory, though more expensive. The physical condition of the ewe at time of breeding has an important bearing on the lamb crop both as to quality and quantity. For late fall and winter feeding of ewes alfalfa or clover hay with not over 2 pounds per day per head of turnips, mangels, sugar beets, or silage will be good; this will not put much fat on the ewes, but will keep them in fine condition.

About one month before lambing time it is well to add grain to the ration. A good grain mixture is at the rate of $1\frac{1}{2}$ pounds of oats to 1 pound of bran, giving each ewe about a half pound of the mixture daily. Care should be taken not to feed sour or spoiled silage or frozen roots and silage, as such feed will at least cause abortion if not the death of the ewes. After lambing care must be taken to prevent milk fever, and this is best done by eliminating all grain from the ration for about three days, making no decrease in the roughage and roots. The grain may be returned gradually to the ration after the third day.

Rations for lambs are governed by the market for which the lambs are being fitted. If they are the so-called hothouse lambs which come early and are to be prepared quickly for market, they should be given plenty of nutritious food and forced all possible. When the lambs are about two weeks old they will begin to nibble at the grain and roughage with their mothers. If it has been possible for you to save a few roots, they will be most valuable for the lambs at this time. If possible arrange to give the lambs special feed now in addition to the mother's milk. This may be done by the use of lamb "creeps," which are partitions across ends or corners of the yard with cracks just wide enough to permit the lambs to creep through to eat of ground grain placed in troughs there for them. Choice bunches of alfalfa may also be placed for them to help hurry them to the market.

If the lambs are of the regular late crop and to be utilized for winter feeding it is not necessary to give them special feed. The ewe's milk and alfalfa pasture will put them in fine shape for winter feeding.

In putting ewes and lambs on alfalfa pasture care must be taken to prevent loss by bloating. They should be well filled with cured hay before going on the alfalfa, and when once on the alfalfa should be left there unmolested. Do not attempt to drive them from the alfalfa to other fields for watering, as such a plan causes fermenta-

tion of the food in their stomachs and bloating results. Fresh water must be available in the alfalfa pasture at all times.

When the grain is harvested, the sheep may well be turned into the stubble to pick up lost grain and weeds. If sugar beets are raised, the sheep may be turned into the beet field after harvest, and they will make good gains on the beet tops. All available pasturage should be availed of before cold and stormy weather sets in, when it will be necessary to confine the sheep to the yards and feed them the more expensive feeds.

When the yard feeding begins, the sheep should be sorted as to size, and different sizes fed in separate yards. The breeding stock should be separated from the feeders. Mention has been made of rations for breeding ewes. The sheep that are to be fattened may be started on a straight alfalfa hay ration, receiving all they will clean up well. As the feeding period advances, or after two or three weeks' time, grain may be added gradually to the ration, starting with only 1 to 2 ounces per head per day and increasing until the equivalent of 1 pound of wheat per head per day is given. The grain portion of the ration may be either wheat, oats, corn, or barley, or a mixture.

Careful watch must be kept on the sheep to see that they are not affected by constipation. If the droppings are hard, dry, and black, some laxative should be added to the ration; this may be accomplished by adding a small amount of bran, oil meal, or flaxseed to the amount of 2 per cent of the grain ration.

Sheep with good mouths are well equipped to grind their own grain, and nothing is gained by grinding it for them. If sheep with broken mouths are being fed, it will be necessary to provide ground grains, silage, roots, or beet pulp for them.

Extensive experiments have shown that it is not safe to feed sugar beets or mangels to rams or wethers. It has been found that such roots cause gravel stones in the kidneys and bladders, and that rams and wethers can not pass these stones through the urinary canal and death results. Ewes may be fed mangels and sugar beets with good results.

Be punctual in feeding sheep. Variations in time of feeding are as harmful as variations in quality or amount of feed.

Have fresh, clean water before the sheep all the time; this is highly important.

Another important item is clean salt. Salt furnishes chlorine for the digestive juices of the stomach and aids the proper functions of the body organs. Without it indigestion will result. If given only at intervals, the sheep will eat too much, then drink too much water, and scouring results. Keep salt before the sheep constantly.

FATTENING SHEEP.

Practically every article on the subject of feeding sheep contains the warning to make gradual changes in and additions to the rations of the sheep. Particularly is it necessary to add concentrated feeds, like oats or corn, to the ration if the best results are to be had. A writer in an Oklahoma farm paper has gone more into detail on this point and has made out a very practical program to guide the feeder. The table he gives refers particularly to feeding of lambs, but the ration is plenty heavy for matured sheep.

A plan that has proven very satisfactory with 60-pound lambs of normal thrift consists in starting the feeding of grain by giving 1 pound for each 20 lambs the first day and increasing the feed 1 pound per day for every 20 lambs, until the twentieth day, when they would be getting 1 pound per head per day. The following table sets forth the details of this plan, being a plan for starting 100 lambs:

Day.	Allowance of grain.			Day.	Allowance of grain.		
	Oats.	Corn.	Total grain.		Oats.	Corn.	Total grain
	<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>		<i>Pounds.</i>	<i>Pounds.</i>	<i>Pounds.</i>
First.....	5		5	Eleventh.....		55	55
Second.....	10		10	Twelfth.....		60	60
Third.....	15		15	Thirteenth.....		65	65
Fourth.....	20		20	Fourteenth.....		70	70
Fifth.....	20	5	25	Fifteenth.....		75	75
Sixth.....	20	10	30	Sixteenth.....		80	80
Seventh.....	20	15	35	Seventeenth.....		85	85
Eighth.....	20	20	40	Eighteenth.....		90	90
Ninth.....	15	30	45	Nineteenth.....		95	95
Tenth.....	10	40	50	Twentieth.....		100	100

Alfalfa or cowpea hay should be supplied according to the appetites of the animals. These legume roughages are needed when corn or a grain sorghum is the only concentrate fed.

Thrifty lambs, weighing 60 pounds, will usually clean up readily all that is mentioned in the above table. However, the feeder should watch very carefully to be sure that they are cleaning up all that is given them; and if necessary, the plan should be altered to suit the appetites of the lambs.

HOGS.

HOGS ON THE IRRIGATED FARM.

Any enthusiast who is contemplating going into the "swine-rearing" business can with a pencil and paper show you in 10 minutes how he will become a millionaire within a few years. He can prove it to you, the facts on paper are incontrovertible, and the only argument you can present is to ask yourself why all farmers who raise hogs are not millionaires.

Farmers should realize, however, that hog profits are not altogether on paper. It is being demonstrated on practically every project by some few farmers that hogs can be raised with profit in excess of what may be reasonably expected from many other sources on the farm.

Hog raising, like the other branches of live-stock business, should be taken up slowly and the necessary experience gained as the business increases. Many of the heavy losses in this work are due to enthusiasm getting the better of good judgment. Local conditions must be studied, and this includes market conditions. The safe plan is to start in a small way and increase your stock as your ability and equipment to handle the work increase.

Do not accept the theory that you must have the most modern of buildings and equipment in order to successfully handle hogs. Some of the most serious failures in this work have been experienced by men who have invested thousands of dollars in buildings and equipment, but who lack experience and the necessary good judgment. Satisfactory quarters for hogs may be had without great expense.

There is no best breed of hogs. Markets and other conditions should be considered in this connection, and it is well for a community of farmers to join in raising the same breed of hogs, as this will lessen the expense of introducing new blood and facilitate making up carload shipments of uniform quality.

One of the serious drawbacks to hog raising is hog cholera. Millions of dollars are spent annually for cures for hog cholera, but these widely heralded cures are making but slow progress in stamping out this disease. Based on experiments made by the Department of Agriculture, which extend over a long period of years, and upon the

observations and experience of our most practical hog raisers, it is recognized that the best safeguards against losses by hog cholera are measures which prevent the disease, and the greatest of these preventative measures is just plain cleanliness. Try it. Keep your hog houses and yards clean and feed clean food.

The old practice of shutting hogs in pens and feeding them refuse from the kitchen, corn, grain, and water is giving way to the better plan of pasturing hogs, running them on good forage, and thereby refusing the amount of high-priced grain necessary to put on fat. Many favorable reports are being circulated of results secured by running hogs on alfalfa pasture with addition of sufficient corn or small grain to make a balanced ration. The practice of hogging off corn is also gaining in favor to the extent that what was once looked upon as a wasteful plan of harvesting corn is recognized as an economical method of feeding corn with the added advantage of having the manure evenly distributed over the fields.

How to market the alfalfa crop is one of the serious problems on a number of the projects, and this question will not be satisfactorily settled until the farmers are able to feed their entire alfalfa production. One of the quickest ways to get a pig to the packing plant is through a patch of alfalfa, but do not try to fatten hogs on alfalfa alone. Pigs will grow when pastured on straight alfalfa, but to put on fat at the least expense add a little grain to the daily ration.

Hogs may be converted into cash as quickly as anything produced on the farm. There is always a demand for good pork. To start raising hogs requires but very little outlay of money, yet the returns are quick and the business grows rapidly. Run hogs in the stubble after you have taken off the grain; feed them what you cull out of your garden and out of the orchard; you will always find a hog ready to eat and anxious to convert into pork much of the present waste on your farm.

Hogs have paid off as many farm mortgages in the corn belt as all other departments of corn-belt farming combined, and they will be found just as efficient in meeting water-right payments.

FEEDING HOGS.

It is a well-established principle that the man who goes into the stock business strong when he thinks the conditions are just right and who goes out when he thinks the conditions are not just right seldom, if ever, prospers in the stock business. The men who prosper through live stock are those who consistently year after year handle sufficient live stock to consume the products of their fields. There is no merit in the plan of going into and out of stock work in an effort to outguess market conditions. A disadvantage of this plan is that any break in

the handling of stock is a serious setback in the upbuilding of the farm droves and herds, and it fails to bring returns for the money invested in buildings and equipment year after year. Another condition is that the farmer is rarely able to "guess" when he should go into and out of the business, and the result is he is usually out when he should be in. If you are going to handle live stock, make a permanent and continuous business. Use good judgment in what you feed and when you feed it, but keep everlastingly with the live stock and you will profit.

The farmers on our projects are particularly well situated to handle hogs. You all have plenty of alfalfa, and it is an accepted fact that with alfalfa pasture as a basis for hog feeding and with the addition of small grain or corn in amounts to suit the particular period of the feeding, you have feed that will produce good pork as cheaply as it may be produced.

While it is not desired to go into the details of experiments in feeding hogs on alfalfa pasture, it may be stated here that numerous tests have been made under all ordinary conditions, and the returns to be had from alfalfa pasture through pork range from \$20 to above \$80 per acre after full allowance at market price has been made for all grain fed. This is a good return when it is considered that the hogs do the work.

Following up these experiments tests are now being made in running hogs on alfalfa pasture and requiring them to harvest in addition their own small grain or corn. The present status of these experiments tends to show that the hog has no objection to acting as a grain harvester or corn husker, and the farmer will save what he has heretofore spent in shucking corn and thrashing grain for hogs.

Year after year hogs have heretofore returned profits to the farmers under conditions not nearly so favorable as our farmers may now take advantage of. There is no reason why our farmers should let up in hog raising or feeding. The returns and profits will be in accordance with the skill and knowledge applied, and the profits should be such as to encourage them to stay in a work which they are as well, or better, situated to handle as the average farmer of this country.

♦ HOG RATIONS.

Due to the fact that hogs are raised to some extent on practically every American farm and to the universal use of these animals in marketing field crops it is probable that more has been written on the subject of hog rations than on any other feeding topic. Because of the great amount of information to be had on this subject no attempt will be made in this article to cover the subject in a general way, but rather simple and effective methods under conditions on our projects will be pointed out.

On most of our projects we have alfalfa in plenty and this furnishes the best and most economical basis for hog rations. Alfalfa should be considered as a basis for a ration and not an entire ration. I have read accounts of hogs being marketed with profit after having eaten nothing but alfalfa until within a few weeks of the time of marketing. Hogs raised on a practically straight alfalfa ration require a longer time to reach full development and then go to market with poorer finish than is possible on a properly balanced ration. In addition, this increased time during which the hogs are held on the farm also increases the risks to the hogs from disease.

Corn, wheat, barley, oats, field peas, and similar feeds are to be had at reasonable cost on all the projects. The best plan is for the farmer to utilize his alfalfa and the grain which is to be had most cheaply in his neighborhood, results considered. Corn and alfalfa make an ideal hog ration, and if both are available nothing is to be desired. If corn is scarce or high priced, wheat, barley, oats, peas, mixed or straight, or any one of them, may be utilized profitably with alfalfa. It is generally held that it is economical to grind all grain fed to hogs, and if grinding is not feasible the grain may be soaked.

Beginning with the brood sow before farrowing time, a good ration would be free access to third cutting of alfalfa hay in racks, or alfalfa pasture, with from 1 to 2 per cent of the live weight of the sow in corn, wheat, or barley. Skim milk and slops from the kitchen may be added with good results. This ration will keep the sow in good condition and enable her to produce lusty pigs. The sow will not require food during the first 24 hours after farrowing, but give her plenty of clean water which is not cold. The first feed may well be a slop made of such ground grain as is available, starting with a small amount and increasing gradually until the maximum ration is reached about 30 days after farrowing. At this time she should be receiving daily about 4 to $4\frac{1}{2}$ per cent of her live weight in ground or soaked grain, with free access to third-cutting alfalfa or alfalfa pasture. If alfalfa hay is fed the addition of a few roots, such as sugar beet or mangel, will increase the milk flow. When the pigs are three to four weeks old they should be given access to slops made of ground grain and placed where the mature hogs can not reach it. This side feed for the pigs may be gradually increased until when they are 7 to 10 weeks of age they may be weaned. They should be able to make rapid gains on the grain and alfalfa pasture, giving them all the grain slop they will clean up quickly twice each day. On this kind of ration the pigs should be brought to weigh from 200 to 250 pounds between March 1 and October or November.

After the pigs are weaned the sows may be kept on alfalfa pasture and the grain ration reduced to a small amount, just enough to enable the sow to regain her lost flesh.

There are many variations to the above simple method of feeding hogs on our projects. Among these may be mentioned the hogging down of grain and corn. If the farmer has some experience with hogs and has properly arranged his fencing, he may profitably hog off small fields of grain, saving the thrashing bill and some labor.

A great deal of attention is being given the self-feeder plan of feeding hogs, by which they are given free access to both grain and alfalfa. The best results from this plan appear to be had where several varieties of grain are available and the hogs may have their choice and mix their own feed. This plan is worth trying. The principal arguments in its favor are that it is a labor saver, in that the self-feeders are filled and this feature requires no attention until the feeder is emptied by the hogs. Also tests have shown that the hogs reach marketing condition with economical use of grain and in comparatively short periods of time.

Under any plan of feeding there should be before the hogs at all times a mixture of wood ashes, air-slaked lime, sulphur, and copperas. A good mineral mixture recommended by the Department of Agriculture is: Charcoal, 1 bushel; hardwood ashes, 1 bushel; salt, 8 pounds; air-slaked lime, 8 pounds; sulphur, 4 pounds; and copperas, 2 pounds.

Hogs require plenty of fresh, clean water. During the hot months shades should be provided. A good plan is to make a roof of boards 3 to 5 feet off the ground, leaving it open on all sides.

Last, but not least, keep the feeding places clean. Cleanliness in feeding hogs is as important as in feeding other stock. The causes of many hog losses from disease are unclean quarters and feeding places.

BE YOUR OWN BUTCHER.

Many of us are going to be old-fashioned this fall and be our own butchers. In some sections it has been so long since farmers did their own butchering and meat curing that there are few who know just how to proceed. I have clipped from a current paper some suggestions for the farmer butcher, and they are given below. They tell in a short way about all that is necessary to secure well-cured meat on the farm.

1. Wait for a spell of really cool, dry weather to butcher.
2. Keep the hogs clean before as well as after killing.
3. Never stick a hog on one side in the shoulder; it simply wastes good shoulder meat. Stick the middle of the throat.
4. Do not stick too deep.
5. Do not have the water hotter than 180°—better 150°.
6. A little soft soap or wood ashes added to the water helps get the hair clean.
7. Do not put cold water on the carcass until the last thing after it is completely dressed.

8. Never allow meat to freeze that is to be cured.
9. Always allow meat to stand at least 24 hours before salting.
10. Use plenty of salt.
11. Never use a vinegar or whisky barrel for meat.
12. Keep meat covered with pickle at all times.
13. Use a stone and not an iron to weight the meat down.
14. Smoke the meat a little each day rather than for a long time at a stretch.
15. Try and keep the smoke circulating around the meat.
16. A dash of red pepper on the fire adds to the flavor of the meat.
17. Have enough, but not too much, creosote in the smoke.
18. Keep meat out of the heat from the fire.
19. Never wash the smoked meat.
20. See that it is carefully packed in air-tight packages.
21. Store it in a dry, cool place.

CURING PORK.

Missouri has long been famous for home-cured pork, and the following rules for dry-cured and brine-cured pork are from a Missouri authority and surely must be reliable.

DRY CURE.

Do not cut up the pork till the carcass is well chilled. Make a mixture of clean, fine salt, 40 pounds; white or brown sugar, 10 pounds; white or black pepper, 4 pounds; red pepper, one-half pound. This will make enough cure for about 1,000 pounds of pork. If saltpeter is desired, use 2 pounds in the above mixture. It will give a red color to the lean meat, but has a tendency to harden the meat too much. Chili saltpeter may be used instead of the regular saltpeter by taking about 20 per cent less.

Rub each piece of meat thoroughly with the cure. Take special care to work the cure around the ends of bone of hams and shoulders. Pack skin down on a table or in a box in a cool, airy place. Do not place in direct sunlight or in a damp, musty cellar. After four or five days overhaul the meat, rub thoroughly with the cure, and repack; repeat this in about a week. Hams and shoulders should remain in the cure from one and one-half days to two days per pound weight of piece; the latter time is safer for meat that is to be kept during the summer. Bacon should be in the cure a shorter time. Ten days will give a very nice mild cure to a 6 or 8 pound piece.

BRINE CURE.

Make a brine by boiling 7 pounds of clean salt and 2 pounds of white or brown sugar with 2 gallons of water. If saltpeter is desired, add one-fourth pound. This gives about enough to cover 100 pounds of pork when well packed. Sprinkle a little clean, fine salt in the bottom of the barrel, rub each piece of meat lightly with the salt, sprinkle

a light layer of salt between each layer of meat. Put on a board and weight down with a rock. Allow to stand overnight. Tip barrel on side and allow the liquor to run out. Cover the meat with the cold brine and allow to stand in a cool place four or five days. Overhaul, repack, and cover with the same brine. Repeat in about a week. Give the meat the same length of time for curing as with the dry cure.

When the curing is complete, wash off the excess cure and hang in the smokehouse. Meat kept in the cure too long should be soaked in warm water to remove the excess of the cure. Smoke with hickory, oak, apple, or any nonresinous wood. Avoid all wood of the pine family. With a continuous smudge the smoking can be completed in 24 hours. With intermittent smoking, longer time is necessary, as cold meat "takes the smoke" slowly. Wrap the meat to keep it away from the skippers. If rats or mice get at the meat they open a way for skippers. In damp weather cured meats will mold. This is not injurious except it is advisable to use up shoulders, as the mold grows in the cracks and calls for extensive trimming.

HOG CHOLERA.

The warnings and necessary precautions against hog cholera are often placed before the public, but a repetition is never out of place. Here are the simple precautions recognized as necessary:

1. Do not have hog lots near streams, highways, or railroads.
2. Do not allow pigeons to feed in your hog lots. Keep crows and buzzards away.
3. Quarantine all hogs brought to your place until you are sure they are free from cholera.
4. Do not permit patent-medicine men to visit your hog lots; they may just have left infected places.
5. Disinfect your shoes, your clothes, wagon wheels, and horses' feet after hauling hogs to stockyards.
6. Disinfect lots and buildings at least twice a year, using slacked lime and carbolic acid solution.

The symptoms of cholera are several and include loss of appetite, lagging, staggering walk, abnormal thirst, coughing, vomiting, bleeding nose, sunken flanks, inflamed eyes, and sometimes constipation and sometimes diarrhea.

On a number of Reclamation Service projects the Department of Agriculture has stationed agriculturists especially trained in animal husbandry, and the settlers on projects so favored can call upon the agriculturists when cholera is suspected and secure immediate aid in combating the disease.

Some security can also be had through inoculation of the hogs.

DAIRY STOCK AND DAIRYING.

The subjects of dairy stock and dairy farming are now receiving much attention throughout the country, particularly in the newer sections where dairying has not been followed and where dairy stock is now scarce.

On many of the irrigation projects special effort is being made by individual farmers and by groups and associations of farmers to secure dairy stock. In many cases the settlers are short of funds and can not, without assistance, secure the cows considered necessary for the profitable working of their farms. In these cases business men and banks have come forward and advanced the funds, securing the return of the loan, with interest, by mortgages.

In connection with the purchase of dairy stock, I want to impress upon the water users my ideas of the advantageous plan. To supply the dairy stock for our newer sections we must buy from other sections where dairying has been followed for many years. In these older dairying districts the dairy business in all its details has been given close attention and there is constant effort to build up the dairy herds by eliminating therefrom cows which are unsatisfactory producers. There are thrown on the market each year in these established dairying sections many cows, good in appearance and conforming in a general way to the physical requirements of good milch cows, but which are actually unsatisfactory producers.

Dairy cows of proven merit are obtained only at a high premium. The purchaser of dairy cows must bear in mind that a matured cow of proven merit is not for sale in any place in the United States for the average price which the settler in the new sections can afford to pay. Consequently, if matured stock is purchased at fair prices, the chances are strong that such cows have been discarded from the older herds as being unsatisfactory producers. It is a poor investment to purchase on borrowed money, for which a high rate of interest is exacted, cows which are culls discarded from the herds of experienced dairymen.

In my opinion, the most advantageous method of purchasing dairy stock is to send some good judge of such stock to a dairying section and have him purchase young stock, not yet producing. Out of this young stock a fair average of first-class milch cows will be secured and the poorest of the lot will probably develop into milch cows equal

in merit to the average that may be secured by purchasing matured cows at a fair price.

To sum the matter up: If you purchase mature cows you will pay a handsome premium for those that have proven to be good producers or you will secure for a fair price the culls from the experienced dairyman's herd. If you purchase young stock you will secure some first-class cows, some fair cows, and some poor cows, but the average will be far above the average mature cow purchased and the investment will be much less.

To every farmer on the Government irrigation projects I say, by all means get some dairy stock. The importance of dairying in connection with better farming should not be overlooked. A careful review of the history of every section of our country fails to show one instance where dairying followed in a practical way has not worked out successfully to the permanent profit of the people so engaged. On the other hand, in sections where the farmers have devoted themselves entirely to producing and marketing cereal and similar crops the prosperity of the community has gradually decreased.

Every agricultural publication of to-day is advocating dairy work and many good books are being written on this subject. Practically every agricultural expert throughout the country is in some measure talking in favor of dairying and stock raising in general. A number of arguments in favor of dairying are:

It provides a cash income for the farmer 12 months in the year.

It furnishes a sure and profitable market for forage and grain crops.

It provides, through fertilizer, for the upkeep of the soil.

It aids in the establishment of a system of crop rotation and diversified farming to which every farmer should earnestly turn his attention.

It must be kept in mind, however, that success in dairy work depends entirely upon the man. While the selection of good stock is generally considered the most important item, it is a fact that the care of the stock, the vigilant methods employed in feeding and herd improvement and the businesslike handling of the dairy products are necessary to success with the best stock that can be secured.

Get some dairy stock, make your plans well ahead, handle the work in a businesslike and thorough manner, and you will be recompensed well and permanently

DAIRY COW RATIONS.

I recently read a description of a plant which fastens itself to telephone and telegraph wires and, with no means of subsistence other than it can secure from the air, it grows and multiplies.

There is great demand for a breed of milch cows which will support themselves by some such simple process. I have known some farmers—not many, of course—who appeared to be trying to accustom their cows to such a means of livelihood.

The milch cow should be considered a manufacturing plant—nothing more or less. What you take from a cow is governed directly by what you put into the cow. It is true some cows are more efficient than others, just as some manufacturing plants are more efficient than others. You need not expect large yields of milk from cows which you feed unnutritious material any more than you could expect to get grain by running thrashed straw through a separator.

The cow is so constituted that she can digest and assimilate about double the amount of food necessary to maintain her body. When the cow is furnished with all the food she can digest and assimilate, the excess over the amount utilized in maintaining her body is turned into fat or milk. A good dairy cow turns this excess into milk, and a beef type cow adds fat to her body. It should be understood that the cow first utilizes all the food necessary to maintain her body before devoting any to fat or milk production. Therefore, in order to secure the maximum amount of milk it is necessary to provide the cow with all the food she can utilize.

As fully important as quantity of food is quality of food. Any manufacturing plant turning out a product must have the raw materials in proper proportions as well as sufficient quantities. If the finished product is composed of both wood and steel, you need not expect efficiency from the factory if you furnish all wood and no steel materials nor if you furnish half enough wood and double the amount of steel necessary.

Milk is composed of certain fixed elements, and the foods furnished the cow must contain protein, carbohydrates, and fats in proper proportions if the cow is to do her best work. Those who have made a study of milk production generally agree that the proportion of these elements should be about one of protein to five and a half or six of carbohydrates and fats. It will be found that cows vary with regard to the amounts of the raw materials they require to secure good results. Some cows make more efficient use of hay than others, and the same is true of grains and more concentrated foods. These variations are particularly noticeable between the different breeds of dairy cows. The skilled dairyman discovers these variations and uses the feeds he has to the best advantage.

Pasture is an important item in dairy cow rations. In starting cows on pasture in the spring they should be allowed to graze only a few hours each day, and the time of grazing may be extended gradually. The first growths of pasture are usually watery and compara-

tively low in nutriment. Unlimited access to this kind of pasturage is liable to disarrange the cow's digestive organs and usually a bad taste is noticeable in the milk. The grain ration should be continued for a time after the cows are started on grass, and the grain gradually decreased as the pasture becomes stronger until when the pasture is at its best no grain is required for good results.

As the pasture dries up in the late summer and fall the cows should be given a little green fodder, alfalfa, clover, or other succulent food to prevent a let down in the milk production and a shortening of the milking period.

As the pasturing season draws to an end the ration should be changed gradually to cured hay, with silage or roots and a small allowance of grain.

On all of our irrigation projects alfalfa hay is available, and this is a great boon to the dairy farmer. When good alfalfa hay is to be had there is no use in spending money for the high-priced protein feeds, such as bran, oil cake, etc.

Some of our dairymen feed nothing but alfalfa hay during the winter months, and they stoutly maintain their returns are as good as may be secured by adding silage or grain or both to the ration. Experiments have demonstrated some very fine results from alfalfa straight, but there is the important matter of continuously maintaining the cow in the best of bodily strength in and out of the milking period and enabling her to produce lusty calves. To do this it is important that food elements not present in alfalfa hay be supplied, and it is economy to round out the ration by proper portions of silage or roots and grain. This follows the idea of supplying the proper food in the proper proportion to secure the most efficient use of the cow's powers of digestion and assimilation.

A method considered good by successful dairymen is to give the cow all the alfalfa hay she will use, add 1 pound of silage or roots for each pound of milk produced daily, and 1 pound of grain for each 3 pounds of milk produced daily. This is, of course, a full day's ration.

Use particular care in the periods of change from one ration to another. Make no sudden changes; one food should be replaced gradually by another. And when you feed the cows smile just as you do when you go to the bank to secure a loan—the cow is more susceptible and responsive to smiles than any banker.

WINTER FEEDS.

In view of the strong demand for grains to be used as human food, it is well for our farmers to figure out live-stock rations as near grainless as may be and still insure thrift and growth during the winter.

A recent issue of the Agricultural Digest contains the following article on legumes, and it should be good news to our alfalfa growers to learn that this plant of plenty heads the list of valuable legumes, and, in comparison with high-priced feeds, makes a remarkable showing.

LEGUMES FOR DAIRY COWS.

The dairyman who raises an abundance of leguminous roughage establishes a basis for an economical home-grown ration which makes it unnecessary for him to purchase protein-rich feeds, according to the United States Department of Agriculture. Good, properly cured hay from any of the common legumes has a high percentage of digestible protein.

The following table shows the comparative values of several common roughages and concentrates:

[Per acre.]

Crop.	Yield.	Digestible protein.	Digestible carbohydrates.	Digestible fat.	Total of nutrients (fat $\times 2\frac{1}{2}$).
Alfalfa hay.....	2½	530	1,950	45	2,581
Cowpea hay.....	1½	393	1,011	30	1,471
Red-clover hay.....	1½	190	982	45	1,273
Peanut vines, nuts removed.....	1	132	740	60	1,007
Soy-bean hay.....	1½	292	980	30	1,339
Sweet-clover hay.....	2	436	1,538	28	2,337
Oat-and-pea hay.....	1½	207	917	38	1,209
Timothy hay.....	1	60	850	24	970
Corn silage.....	8	176	2,400	112	2,828
1 ton bran.....	.....	250	832	60	1,217
1 ton corn meal.....	.....	138	1,380	70	1,676
Velvet beans.....	1½	360	1,209	42	1,663

This table shows that an acre of good alfalfa furnishes twice as much protein as a ton of bran, four times as much as a ton of corn meal, and nine times as much as an acre of timothy. When the ration consists of an abundance of silage and good legume hay, cows of moderate production often require but little grain. Cows which give more than 25 or 30 pounds of milk daily require the addition of concentrates if high production is to be maintained. In view of the probable shortage in grains, all dairymen should make every effort to provide an abundance of leguminous hay by growing legumes suitable to their soils and sections.

EFFICIENCY VARIATIONS IN COWS.

Recent experiments conducted on the Truckee-Carson project by the Department of Agriculture show in a marked way the variation in the efficiency of different cows in turning feed into milk. It is believed worth while to make the results of this experiment known to all our water users.

In this experiment the price of skim milk was placed at 25 cents per 100 pounds; butter fat at 26.6 cents per pound; third cutting of alfalfa was used.

Name.	Months since fresh.	Hay required to produce 100 pounds of milk.	Hay required to produce 1 pound of butter fat.	Value of product per ton of hay consumed.
Jane.....	7	164.7	41.18	\$15.94
Brown Babe.....	6	244.0	31.04	16.40
Blossom.....	10½	244.0	59.50	10.98
Lady.....	6	105.0	21.50	29.56
Bessie.....	7	500.0	83.30	7.38
Andy.....	8	221.0	39.40	15.74
Watkins.....	4	144.0	28.90	21.82
Brindle.....	4	196.0	36.40	17.08
Brunette.....	3	154.3	30.28	20.68

It will be noted that one cow paid \$29.56 per ton for the hay while another paid only \$7.38. Get acquainted with your cows; it might be profitable.

KEEP THE CALVES.

If you profit by the experience of those who have been "through the mill," you will work into the dairy business slowly, "grow into it rather than go into it." Also you will find there is no better plan than that of raising your own dairy stock.

The idea of a great many people is that when they get matters fixed just right they will buy up a good bunch of dairy cows, and from then on their principal occupation will be cashing cream checks. The majority of men successful in dairy work did not succeed by any such plan. As a matter of fact, most of the failures in this work have been men who started out with an unknown bunch of cows that other people were glad to dispose of.

The right way is to start with one, two, or three really good cows—know that you are getting something good, even though it costs considerable extra. Use the best available sire on these good cows and keep the heifer calves.

On the average, when you buy a dairy heifer you pay the other man a profit over what it has cost him to raise the heifer, and still you don't know just what you are buying. It averages cheaper and safer, therefore, to raise your own dairy heifers.

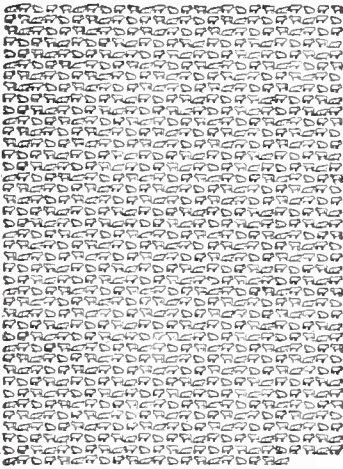
Several of the State experiment stations have experimented and given out figures on the costs of raising dairy heifers. The costs as given out in the bulletins are surprising in that it is shown that it costs as much as \$60 to \$70 to bring a heifer up to 2 years of age. These figures have discouraged many farmers from endeavoring to raise their own heifers. They reckon they can buy the heifers at

2 years of age cheaper than they can raise them, and they take no risks of loss in the raising. This would be good reasoning if farmers were in the habit of utilizing every item of what is raised on the farm, and also if they could be reasonably sure the dairy heifers they can buy are worth anything at all above their value as beef. On the average farm the feed necessary to raise two or three heifers is not an important factor, as the average farmer wastes several times that amount every year.

It is a recognized fact that the value of a dairy cow is governed largely by the care and skill used in bringing her to the productive age. It is not enough that the heifer merely lives through the first two years. It is very important that she be kept in prime condition throughout this period and that she be handled in such manner as to insure her development into a cow of good disposition. Here lies the great advantage in raising your own dairy stock. Bring them up in the way they should go, and they will not depart therefrom. Do not get worried about what it costs to raise dairy stock; you can raise them for your own use better and cheaper than anyone else if you use good judgment.

There is one best way to get into the dairy farming work. Start with one, two, or three good cows, use a good sire, and keep the heifer calves.

"WHEN THE COWS COME HOME."



1021 COWS AVERAGING
133½ LBS. OF FAT PER YEAR.



25 COWS AVERAGING
301 LBS. OF FAT PER YEAR.

THIS PICTURE SHOWS
EXACTLY HOW MANY COWS
OF THE POOR KIND IT TAKES
TO RETURN IDENTICALLY THE
SAME PROFIT AS
TWENTY-FIVE GOOD COWS.

(ILL. CIR. 118)

HORSES.

BALKY DRIVERS.

You have heard the old saying, "There are more balky drivers than balky horses," and it is in the spring of the year that the truth of this statement is "rubbed in." As spring comes on the farmer who has rested and fattened up takes on a sudden spurt of energy and activity. His first idea is usually to hitch up the team and do something he should have done last fall. He interrupts the attempts of the horses to get a living from the cornstalks and straw stacks, hustles them into harness grown stiff from nonuse, and make them do three days' work the first day when they are not in condition to live comfortably without working.

Of course the man by his unreasonable spurt makes himself lame in the back and all his muscles, and usually takes on a case of spring "snuffles," but our sympathies are with the horses. Pushed into heavy work without even a few days' preparation by feed and care, any horse is in bad shape to stand the hard strain of field spring work. The result is gradual loss of flesh and strength and increasing nervousness for the horse. The farmer then crams into the horse heavy feeds of grain—part of which should have been given before the hard work started—and the condition of the horse is seldom helped, and quite often made worse by the burden added to its digestive organs, which are sensitive at all times. It is from such conditions that what we call "balky horses" are developed, but this term is usually a libel on the horse. When we say "balky horse," we mean "balky driver," if we understand the real cause of the trouble.

To start an unconditioned horse suddenly into heavy work is like starting a locomotive by throwing the throttle wide open—the effect on both is the same. Remember your horse is a highly sensitive piece of machinery and should be treated accordingly. Any lack of care of the horse means a corresponding loss in the efficiency of the horse.

Don't be a balky driver.

HORSE RATIONS.

The people of this country have acquired the opinion that there are only a few items of food suited for horse rations. In certain sections of the country it is held that only timothy hay and corn or timothy hay and oats make a proper work-horse ration. Other sections of the country are willing to substitute corn leaves, alfalfa, bluestem, or oat hay for the timothy hay and in some sections crushed barley is used instead of oats or corn.

It would be surprising to some to learn that in some countries horses must live on dried fish and vegetable mold; in other countries milk, flesh balls, eggs, and broth made of sheep heads make up the principal food of horses. In some parts of India salt, pepper, and other spices are mixed with flour and butter, made into small balls, and thrust down the horse's throat. These do not, of course, cover the wide range of items entering into horse rations, but they serve to show that we in this country are a little conservative in our ideas of what horses should eat.

Farmers should bear in mind the important differences between horses and other farm animals, and particularly the point that work horses are expected to withstand long-continued physical exertion, whereas cattle, sheep, and hogs are expected only to produce growth and fat.

The horse has but one stomach and this is limited in capacity. This makes it imperative that horses on hard work be furnished with food of nutritious and strength-giving character but small in bulk.

Horse rations suited to sections other than our Reclamation Service projects will not be considered in this article. On these projects alfalfa is the principal roughage produced and available for horses. On most of the projects the production of corn has not advanced sufficiently to make corn the principal grain food. Oats may be grown to advantage on most of the projects. Alfalfa and oats will, in the main, make up the horse ration for horses on heavy work on our projects.

As a general rule, a horse on hard work should not be given more hay than grain by weight. Where corn is available 10 pounds of alfalfa, 8 pounds of corn, and 2 pounds of oats make an excellent daily ration for a work horse weighing from 1,000 to 1,200 pounds. The amount of the rations may be changed proportionately for lighter or heavier horses. It should not be taken that all horses weighing 1,000 pounds should be given the same ration. Horses vary as to the amount of food required just as people vary in this respect. High-strung and nervous horses require more food than placid and gentle horses—due, of course, to the increased wear and tear on their bodies caused by the tension under which they work. If corn is not available,

fairly good rations may be figured on the basis of 1 pound of oats and 1 pound of alfalfa to each 100 pounds of horse per day.

During winter months or periods of idleness on the part of the horses, a portion of the alfalfa may be replaced by oat straw and the grain ration may be reduced materially or discontinued altogether, depending upon the length or duration of the idle period.

Many farmers are able to bring their horses through the winter in fair shape on alfalfa hay and oat straw. The grain should be replaced gradually in the ration, however, as the period of hard work approaches and the horses gradually worked into heavy work. This will prevent upsetting the sensitive digestive systems of the horses and secure the best returns from the rations.

When you have determined just how much corn, oats, and hay your horses need, you may increase the efficiency of the ration by adding a little kindness.



Blooded horse on a reclamation project.

POULTRY.

POULTRY RATIONS.

If there is one subject that is overworked in our farm papers it is poultry raising. Every farm paper you pick up has its "Poultry pointers," "Pin feathers," "Poultry for profit," and "Swat the rooster" department. My only excuse for venturing a few remarks on poultry rations is that most of the said articles on poultry advocate feeding patent feed mixtures with high-sounding names and correspondingly elevated prices.

The average farm produces feed which may be utilized to good advantage from the time a chicken is hatched until it is marketed.

After hatching, a young chick should not be given food for a period of 24 to 48 hours; then it may be fed a mixture of rolled oats, cracked wheat, barley, buckwheat, cracked corn or kaffir corn, millet, hemp, or such of these grains as may be had conveniently. Chicks should not be given a straight ration of one grain only; safety lies in a mixture, which prevents indigestion. This mixed grain fed dry with milk to drink will make chickens out of chicks in a hurry. In a short time the wheat may be fed whole instead of cracked and the corn given in coarser shape. Do not overfeed during the first month; keep the chicks ready to come when you call. After that time the self-feeder style of feeding may be followed to advantage.

After the chickens are a month to six weeks old a feeding once each day of a mash made up of a mixture of grains and skim milk will be effective. Skim milk will take the place of meat scraps, and it is a very important part of the ration.

In feeding poultry, as in feeding cows, sheep, hogs, or other live stock, you must furnish food suited to secure the desired results. For example, a ration heavy in corn is fine for putting flesh on chickens, but it is not suited to egg production. Eggs contain a large percentage of protein, and this element must be plentiful in the ration for laying hens. A great egg-producing ration is alfalfa leaves steamed with a little corn meal and cracked wheat fed once each day and another feeding the same day of grain in litter to be scratched for.

Chickens must have water, fresh water; they must have grit at all times; and ground bone and charcoal are important additions.

Do not think you have to have all the advertised chicken feeds. They are probably made up of material you have right on the farm; make up a mixture and name it yourself.

FEEDING POINTERS.

FEEDING ALFALFA HAY.

Feeders should always have in mind the constituents of the various feeds they use and know the results obtained from a proper use of these constituents. In a general way live stock require a ration containing proper portions of proteids, fats, and carbohydrates. A lack of any one or two of these constituents can not be made up by an excess of other constituents, and feeding excessively of proteids in an effort to make up for lack of fats or carbohydrates is likely to work harm on the live stock rather than benefits. Alfalfa contains proteids, fats, and carbohydrates, but not in proper proportion to form a ration, and should not be expected, therefore, to be entirely suited to the production of growth, milk, and fat. The principal food constituent of alfalfa is protein, and to make a balanced ration for the average animal there should be added to this some food high in digestive fats and carbohydrates, like corn. Where corn is not to be had reasonably good substitutes may be found in the proper use of kaffir corn, barley, wheat, oats, and rye, though the results will not be identical.

ALFALFA FOR HORSES.

The greatest objection to alfalfa hay is found among horsemen, who claim that it produces ill effects on the organism of the horse. This objection arises from an improper use of a good horse feed. The "soft" condition and the excessive urination of alfalfa-fed horses are the result of feeding too much alfalfa. Fed in proper quantities alfalfa hay makes an ideal feed for horses. The amount should be limited to about 12 pounds per day for a thousand-pound horse or about 20 pounds for a fifteen hundred-pound horse, and the ration should be rounded out by the use of such grain as the farmer has to balance the ration. Horses new to alfalfa should be started in on a small amount, which should be gradually increased until the full feed is reached.

ALFALFA FOR BEEF CATTLE.

Alfalfa works to great advantage in feeding beef cattle. If the hay is high priced and other feeds like corn and silage compara-

tively cheap, the cattle may be given heavy feeds of the corn or silage and then a small amount of alfalfa hay, or if the hay is comparatively cheap the cattle may be given free access to it with a small grain ration added. A full alfalfa feed for a mature steer is from 30 to 35 pounds per day.

ALFALFA FOR DAIRY COWS.

The best returns from alfalfa hay are probably realized in feeding it to dairy cows. This plant loses none of its good qualities in curing, and good, clean alfalfa hay is as strong a producer of milk as is summer pasture. For the best production of milk and upkeep of the cows the hay should be supplemented by ground grains and roots where obtainable. If alfalfa is fed with proper amounts of concentrates and succulent roots, a thousand-pound milch cow will profitably utilize from 20 to 25 pounds of hay per day and heavier cows larger quantities in proportion.

ALFALFA FOR HOGS.

Alfalfa pasture is widely advertised as the ideal pork producer, and in this connection alfalfa hay should not be overlooked. The third or last cutting is considered best for the hogs, as they relish the finer stems and leaves. In case of a long feeding period, it is well to give the hogs a large amount of hay to start with and supplement it with a small amount of grain. The amount of hay may be reduced gradually and the amount of grain accordingly increased. The use of a considerable amount of hay in the early part of the feeding period tends to expand the digestive tract of the hog and enables it to utilize large quantities of concentrates later on.

ALFALFA FOR SHEEP.

Gains may be put on sheep more economically with alfalfa hay as the basis of the ration than with any other feed widely obtainable in this country. Both lambs and aged sheep thrive on the hay, and it gives them a vigor not imparted by other feeds. Sheep may be profitably wintered on straight alfalfa hay, but for fattening purposes it is well to add grain and roots. The sheep to be fattened should be started on alfalfa hay alone and the grain started later, beginning with a very small amount for each sheep. For an average lamb 3 pounds of hay per day will be a full feed, while for the larger aged sheep 4 and $4\frac{1}{2}$ pounds will be utilized.

ALFALFA FOR POULTRY.

The leaves and fine stems of alfalfa hay make a valuable addition to the poultry ration. A most excellent poultry feed may be made

from the leaves and fine stems, or chopped alfalfa, increased in bulk about one-fourth to one-third by ground corn and then steamed.

ALFALFA FOR BROOD STOCK.

Mares, cows, ewes, and sows when kept for breeding purposes should by all means have alfalfa in their ration. Alfalfa is a bone and muscle builder and its laxative tendency, coupled with its cooling effect on the blood, fit it particularly for use during gestation periods.

FEEDING ROOTS.

The feeding of sugar beets, mangels, carrots, turnips, and other succulent roots has never gained the favor in this country that it has in some European countries, where great excellence has been secured in various types of farm animals. Our farmers have not felt that they need to furnish such feed to their live stock and have favored feeds requiring less labor to produce and place before the stock. Of late years silage has been found to add the desired succulence to the live-stock ration. Where good silage is not available, however, farmers should not overlook the advantage of feeding roots.

The common run of roots contain from 70 to 90 per cent water, and the proportion of real food in roots is low when compared with alfalfa hay or grain, but the benefits from feeding roots are not so much in the food contents of the roots as in the effect they have on the balance of the ration and the favorable condition they effect on the organism of the animal.

Fed to dairy cows during the winter months, roots increase the milk flow and assist in keeping the hard-working digestive organs in prime condition. Fed to sheep with a fattening ration, the benefits are readily apparent, as the dangers of constipation are obviated and a relish for the balance of the ration is maintained. Care should be exercised in feeding roots to horses, particularly horses being worked, as the laxative effect will be found objectionable. A few carrots each day, however, will be greatly enjoyed by the horse and good will result.

For hogs and cattle being fattened it is well to start the fattening period with a liberal supply of sugar beets, mangels, or possibly turnips, as it will be found that better results will be had from the high-priced concentrates used in the latter part of the feeding period after the roots are to a great extent taken from the ration.

Experiments have shown that the flesh of animals fed heavily on roots is much softer than that of animals not receiving succulent feed, and on this account there is objection on the part of some people to feeding roots. It will be found, however, that if the feeding of roots is properly regulated as to quantity and gradually decreased as the

feeding period advances there will be no objection to this feed on account of making soft meat.

Because of the softening effect roots may have on the flesh of animals they are particularly valuable when fed in proper amounts to brood sows, mares, ewes, and cows, as the pliable flesh appears to be a condition favoring the easy birth of lusty young animals.

Don't try to make a full ration out of roots alone; use them to supplement the high-priced dry feeds.

Don't be misled by statistics showing that more feed units may be secured at less cost by growing grain or forage than is possible by growing roots. As stated, the main benefit from feeding roots is the efficiency given to other and high-priced feeds and the good effects of succulent food on the digestive organs of the live stock.

If you are not in position to furnish your stock with good silage, you should plan to grow some roots to add to your feeding rations next winter.

FEEDING KINDNESS.

A corn-belt farmer on being asked what he fed his milch cows, replied, "corn and roughness." It is an unfortunate fact that on many farms roughness is administered to the live stock out of proportion to the needs of the animals. The roughness may be supplied through the medium of a milk stool, boot toe, whips, dogs, and "cuss" words, either or all. In any event it unbalances the ration and the live stock is not a source of profit.

I have a friend who is undertaking to raise hogs on quite a large scale as a new venture. The men employed on the ranch are not accustomed to hog raising and have not been overly partial to the "mortgage lifters." Just a few days ago the owner saw one of the men abusing a valuable brood sow and the man was promptly "fired." The owner then made the incident the subject of a lecture to the remaining men, and he told them in effect that he was running a hog ranch and not a man ranch; that he expected to make his profit out of the hogs and if the stock was abused his profit was lost and the ranch a failure. He was right.

You may figure out the best mixture of grain and forage and provide the best of shelter for your stock, but unless you mix in a goodly proportion of kindness you are not going to get maximum returns. If you don't like live stock, don't try to raise live stock; you will be miserable and so will the animals. If you have to beat the cow with the milk stool before you can settle down to milking, there is no use of your weighing the milk and applying the Babcock test to see whether the cow is profitable—she can't be profitable, and it is not the cow's fault, either. If your hogs are so distrustful of you that

you have to get some one else to call them, you won't make money raising hogs. If your horse trembles and shrinks when you come near, it is a sure sign the horse has been in bad company.

One of the biggest of the condensed milk companies advertises that it sells milk produced by "contented cows." I like to trade with people who keep contented cows. It pays to keep the live stock contented. Size up your neighborhood and you will see that the man whose live stock is willing to stay at home is making money out of that live stock, while the man whose stock will go through any kind of a fence to get away from home condemns live stock because it doesn't pay.

Be kind to the pigs, colts, calves, and lambs, and you will have live stock easy to handle and economical to keep. On some farms there is no such thing as "breaking" horses. The colts are handled from birth and they never dispute the authority of the owner. Feed a little kindness; you will enjoy it as much as the live stock. Kindness with stock has the same effect as "taffy" and blarney with men—it will get the desired results where "roughness" would start a riot. Feed kindness.



Friends.

FARM ACCOUNTS.

INVENTORY AND FINANCIAL STATEMENT.

For a number of years there has been general agitation on the subject of farmers keeping accounts. This subject is discussed at practically every farmers' institute and every agricultural publication devotes pages and pages every year telling the farmers to keep books. As a rule farmers have not taken kindly to this proposition. They have been getting along without keeping books and they think they might just as well continue without bookkeeping. They argue that keeping books won't make the fields more fertile or their live stock more prolific, and if they are going into business they might as well move to town and run a grocery store.

The facts are, however, that farmers who keep books are as a rule more successful than farmers who do not keep records. Successful farming of to-day is based on careful planning, and careful planning is impossible without definite knowledge and records of what the fields and live stock have produced under certain conditions in the past. Farming is not the free and easy life, so far as business is concerned, as farmers of 50 years ago made it. Profits in farming to-day are the result of sharp, certain taking advantage of conditions and markets. You must know the producing power of every acre of your land and every animal you feed before you can rightly call yourself a real farmer.

Bookkeeping on the farm is simple. You don't need a diploma from a business college in order to keep records of your business.

Any farmer can revise the following plan of accounts to suit his farm and plan of operation; the idea is to show how simple and yet how useful these records are.

April 1 is a good time to start the year's records on the farm. At that time our average farmer has about cleaned up last year's crops and work and is starting out afresh.

The first thing to do is to take an inventory to find out just what we have on hand and how much we are worth financially. Just sit down and make up a list of your property and your debts. Put down everything, and I warrant you will find you are not so poverty stricken as you have supposed. My most urgent suggestion about farmers keeping books is "*Do it now.*" Following this there is a convenient form for a farmer's inventory and financial statement.

FARMERS' INVENTORY AND FINANCIAL STATEMENT, APRIL 1, 1915.

Assets:

Farm and improvements, including water right on which three payments have been made, 60 acres, at \$80 per acre-----	\$4,800.00
Cash in bank-----	120.00

Grains and produce:

Wheat in bins, 100 bushels, at \$1-----	\$100.00
Alfalfa in stack, 18 tons, at \$5-----	90.00
Potatoes, stored, 100 bushels, at 30 cents-----	30.00
Corn in bins, 95 bushels, at 60 cents-----	57.00
Oats in bins, 300 bushels, at 40 cents-----	120.00
Miscellaneous produce (vegetables, meats, etc.)-----	100.00
	<hr/> 497.00

Live stock:

3 brood mares, at \$185-----	555.00
2 yearling colts, at \$75-----	150.00
1 driving horse (sometimes used in field)-----	150.00
3 milch cows, at \$80-----	240.00
1 heifer, at \$35-----	35.00
6 brood sows, at \$25-----	150.00
10 ewes, at \$5-----	50.00
125 chickens, at 50 cents-----	62.50
7 turkeys, at \$2.50-----	17.50
	<hr/> 1,410.00

Implements:

1 wagon, with box and hayrack-----	55.00
1 sulky plow-----	30.00
1 disk harrow-----	22.50
1 cultivator-----	12.00
1 spike-tooth harrow-----	8.00
1 mower-----	35.00
1 hayrake-----	20.00
1 buggy-----	50.00
Miscellaneous small equipment and repairs-----	175.00
	<hr/> 407.50

Accounts receivable (others owe us):

James Pelly, for seed wheat-----	40.00
Thomas Ware, for heifer calf-----	37.50
	<hr/> 77.50

Total assets----- 7,312.00

Liabilities:

Lumber company, for lumber-----	124.30
Open account at store-----	73.20
Note at bank, with accrued interest-----	1,216.00
Due United States on building charge, \$28 per acre, on 60 acres-----	1,680.00
	<hr/> 3,093.50
Present worth-----	4,218.50

The farm considered in the statement has been taken at 60 acres of irrigable land in the section of the country adapted to general grain, forage, and live-stock production. The settler has come from the

corn belt and for the first few years has been sticking close to what he knew to be good farming there.

Of his total of 60 acres he had during the past year 20 acres in alfalfa, 5 acres in corn, 2 acres in potatoes, 20 acres of wheat, 10 acres of oats, and 3 acres occupied by buildings, garden, feed lots, etc.

He has been renting a grain binder and grain drill.

He has made three annual payments on a \$40 per acre water right, making a total of \$12 per acre paid under the 10-year plan, leaving \$28 per acre due the United States on the building charge. To simplify this matter he will be considered as having made his 1912, 1913, and 1914 payments in advance, and his next building charge payment will become due under the 20-year payment plan December 1, 1915.

APRIL ACCOUNT.

In the last section we had an inventory and financial statement showing the assets and liabilities and the present worth of a farmer on a 60-acre irrigated farm. For the year 1914 his land was in crop as follows: Wheat, 20 acres; oats, 10 acres; alfalfa, 20 acres; corn, 5 acres; potatoes, 2 acres; buildings and lots, 3 acres.

For 1915 he will put in but 7 acres of wheat, using last year's corn and potato ground. Five of the 20 acres of alfalfa will be used for two small pastures, on which will be run to the best advantage the cows, sheep, hogs, and at times the horses. Fifteen acres will be seeded to alfalfa, with a nurse crop of oats; this will be on part of last year's wheat ground, the 15 acres having been fall plowed. The remaining 5 acres of last year's wheat ground will be spring plowed and put in beans. Last year's 10-acre oat field will this year be divided into 5 acres of corn, 2 acres of potatoes, and 3 acres of sugar beets. All the manure available on the farm has been applied to this 10-acre tract.

Beans being a new crop with this farmer, he will keep an accurate account with this crop to ascertain whether it is a money-maker.

Taking advantage of the high prices offered for wheat and horses, the farmer has sold his two yearling colts and 80 bushels of wheat. He has also sold all the potatoes and alfalfa he could spare.

The three milch cows have produced three calves—two heifers and one bull. Two of the brood mares have each produced a colt, one mare failing. The 10 ewes have lambed a total of 10 lambs, 1 ewe not producing and 1 ewe producing twins. The 6 brood sows have produced a total of 42 pigs.

Sufficient hay and grain has been kept to carry all the stock, with the help of the two small alfalfa pastures.

Following is a record of the business transactions for the month of April:

Cash received:

Sold 2 yearling colts, at \$87.50 each-----	\$175. 00
Sold 8 tons alfalfa hay, at \$6-----	48. 00
Sold 5,000 pounds potatoes, at \$1 per hundredweight-----	50. 00
Sold 80 bushels wheat, at \$1.05 per bushel-----	84. 00
Sold 50 dozen eggs, at 20 cents per dozen-----	10. 00
Sold 60 pounds butter fat, at 25 cents per pound-----	15. 00
Received from James Pelly for seed wheat sold last fall--	40. 00

Total cash received----- 422. 00

Cash on hand Apr. 1----- 120. 00

\$542. 00

Cash paid out:

Bought 160 pounds alfalfa seed, at 14 cents per pound-----	22. 40
Bought 150 pounds seed navy beans, at 6 cents per pound--	9. 00
Bought 30 pounds beet seed, at 10 cents per pound-----	3. 00
Bought miscellaneous garden and flower seed-----	3. 20
Bought 1 dozen apple trees-----	3. 60
Paid bill at store to Apr. 1-----	73. 20
Paid lumber company on account -----	65. 00
Paid 3 months' interest, at 8 per cent per annum, on note for \$1,200 at bank; also \$200 on the principal-----	224. 00

Total cash paid out ----- 403. 40

Cash on hand May 1, 1915----- 138. 60

Following is record of expense on 5-acre field of beans:

Apr. 2, to seed navy beans, 150 pounds, at 6 cents-----	\$9. 00
Apr. 5, disking ahead of plow, 1 day-----	5. 00
Apr. 19, 20, 21, plowing and harrowing, 2½ days, at \$5-----	12. 50

MAY ACCOUNT.

The month of May found the farmer very busy in the fields, and as he had carefully arranged his business in April so as to enable him to devote his full time to his fields in May he has but few transactions to record for May.

Following is a record of the business done during the month:

Cash received:

May 3. From Thos. Ware, for heifer calf sold to him in March-----	\$37. 50
May 9. Sold 24 hens, poor layers, to poultry house-----	15. 60
May 31. Check from creamery, 63 pounds butter fat, at 24 cents-----	15. 64
May 31. Check from Commission Co., 40 dozen eggs, at 20 cents-----	8. 00

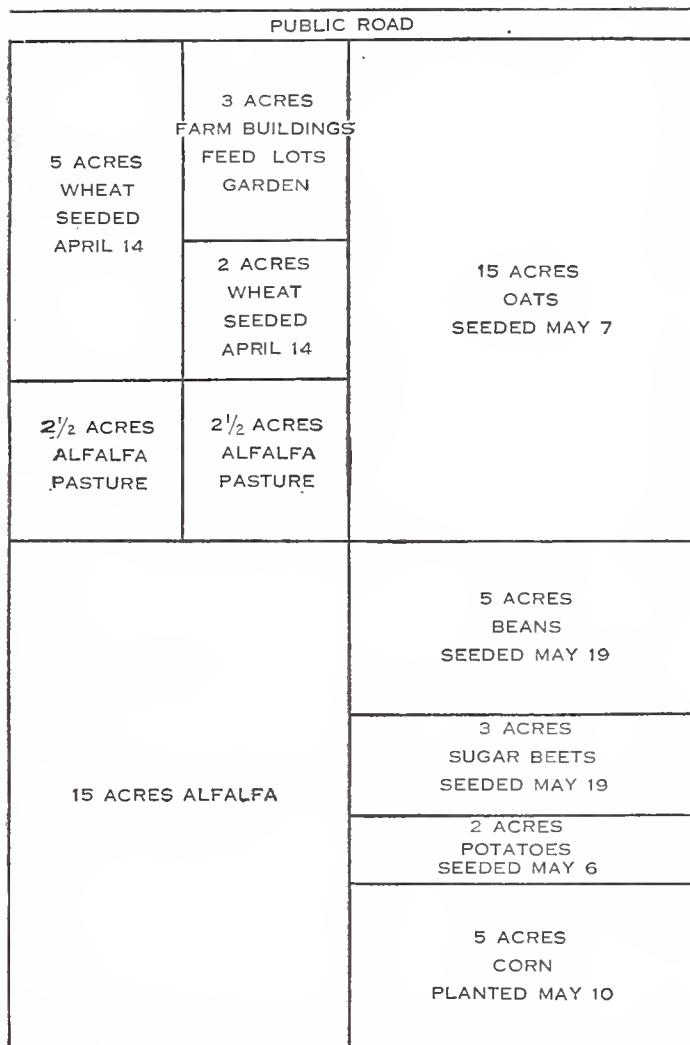
76. 74

Cash on hand May 1, 1915----- 138. 60

\$215. 34

Cash paid out:

May 3. For spraying materials-----	\$9. 15
May 6. Rental on potato planter-----	. 50
May 12. Hired help 3 days, at \$2-----	6. 00
May 15. Paid April bill at store-----	17. 20
May 19. Rental on beet planter (used to plant beans also)	
8 acres at 10 cents-----	. 80
Total paid out-----	\$33. 65
Cash on hand June 1, 1915-----	181. 69



PLAN OF FARM FOR 1915

A good rain occurred May 1 and 2, and as soon as the soil was dry enough all plowed land was harrowed to conserve the moisture.

As indicated in the cash account, a number of hens were sold; these were the hens which had become poor layers and they were culled from the flock and fattened to be sold.

A beet planter was rented to put in the small field of beets and by a little arrangement was also used to plant the beans.

The account on the bean field on May 31 is as follows:

Apr. 2. To seed navy beans, 150 pounds, at 6 cents-----	\$9.00
Apr. 5. Disking ahead of plow, 1 day-----	5.00
Apr. 19-21. Plowing and harrowing, 2½ days, at \$5-----	12.50
May 6. Harrowing, one-half day-----	2.50
May 18-19. Harrowing and planting, three-fourths day-----	3.75
May 19. Rental on beet planter, 5 acres, at 10 cents-----	.50

As has been stated before in this series, it will be necessary for each farmer to arrange his accounts to fit his business. As soon as he is started in keeping record he will probably feel the need of special records or accounts, such as feeding records, breeding records, and cattle or hog records. These he will be able to arrange without trouble. It is particularly desirable to keep hog, cattle, sheep, and horse accounts, charging the stock with the feed and labor and crediting the stock with receipts from sales, increase, produce, services, etc.

A very important item is to have a map for each year, showing the arrangement of the fields, the kinds of crops, dates of seeding, cultivation, harvest, yields, and the net returns on each crop. For the farm we have under consideration the accompanying map represents the farm and its arrangement for the year 1915.

In addition to the bookkeeping records made by the farmer, a diary or written record of daily events will be found useful and profitable. This record may be written up daily, twice each week, or weekly, according to the time the farmer has to spend upon it. Such a diary might read as follows:

May 1.—Rain to-day, with considerable wind. Spent day sprouting potatoes and rearranging root cellar.

May 2.—Rain continued, though lighter. Overhauled spray pump. Found three lambs apparently sick, gave entire flock new straw bedding, and put sick ones in barn and gave them warm feed.

May 3.—Clear weather. One of sick lambs died during night. Went to town, purchased spraying materials; see signs of codling moth on fruit trees.

May 4.—Fine, warm weather. Other two sick lambs died during night. Went to Strong's and rented his potato planter. Took me three hours to put it in running order. All hands cut potatoes after supper.

May 5.—Planted potatoes to-day; soil in fine condition. Alfalfa is coming on in good shape, though the portion of the field which I renovated last month appears to have a better stand.

Etc.

This subject of keeping farm records is not new. It has been practiced by leading farmers for many generations. Among the most interesting writings left by George Washington are his farm records, where we see he put down with great care the details of his farm work.

JUNE ACCOUNT.

The month of June finds the farmer on the rush. If, however, he has planned his work well and arranged his crop rotation to advantage, the 30 days of the month will suffice to properly handle the work.

On the farm we have under consideration the farmer has during the first six workdays irrigated his alfalfa field of 15 acres, one alfalfa pasture of $2\frac{1}{2}$ acres, 7 acres of wheat, and 15 acres of oats. Also, during this week his boy has lightly harrowed the corn, potato, and beet fields to conserve the moisture and prevent weed growth.

From the 9th to the 16th of the month, excepting Sunday, the 13th, the 15-acre alfalfa field has claimed attention, about 20 tons of hay being cut, cured, and put in the stack. During the three days of stacking it was necessary to have the help of one hired man.

Immediately after the alfalfa was stacked the first careful cultivation of the beans, corn, beets, and potatoes was done. This was followed by spraying the beans and potatoes with a Bordeaux mixture as a preventive measure against fungi and blight. The Bordeaux mixture was made of 4 pounds copper sulphate, 4 pounds fresh lime, and 45 to 50 gallons of water.

On the 24th, 25th, and 26th the cultivated fields and the second alfalfa pasture were irrigated. The cultivator was started in the fields again on the 30th, the beans being cultivated on that date.

The following is a record of the business transactions for the month:

Cash on hand June 1, 1915..... \$181. 69

Cash received:

June 3. For 70 pounds of wool, at 24 cents.....	\$16. 80	
30. Ice sold during month, 650 pounds, at 30 cents per hundredweight	1. 95	
30. Check from creamery, 67 pounds butter fat, at 24 cents	16. 08	
30. Check from commission company, 37 dozen eggs, at 22 cents.....	8. 14	
		<u>224. 66</u>

Cash paid out:

June 1. Operation and maintenance charges due Govern- ment, 60 acres, at \$1.....	60. 00	
1. Paid May bill at store.....	19. 70	
10. Repairs to mower.....	2. 50	
16. Hired man, 3 days, haying.....	6. 00	
16. Paid lumber company on account.....	20. 00	
		<u>108. 20</u>

Cash on hand July 1, 1915..... 116. 46

The account with the bean field to date is as follows:

Apr. 2. To seed navy beans, 150 pounds, at 6 cents.....	\$9. 00
5. Disking ahead of plow, 1 day.....	5. 00
19-21. Plowing and harrowing, $2\frac{1}{2}$ days, at \$5.....	12. 50

May	6. Harrowing, one-half day-----	\$2. 50
	18-19. Rental on beet planter-----	. 50
June	18. Cultivating, 1 day-----	3. 50
	25. Spraying, labor, and material-----	5. 00
	26. Irrigating -----	2. 00
	30. Cultivating -----	5. 50

In fixing the rates allowed for labor, both man and horse, on the bean field, it is the idea to allow average wages; that is, wages that will pay the living expenses of men and horses and leave the worker's profit in excess. The fact that the farmer is in this account being well paid for his work should be taken into consideration when the profits or losses on the bean are being determined.

JULY ACCOUNT.

July is a hard month for the farmer. He has been bending every energy in getting his crops well started and in this month he is beginning to harvest his crops. This hurry of harvest, irrigation, and cultivation is what tries the farmer's ability as a manager, and during July he will realize the advantages of having a crop plan or rotation which distributes the heavy work as much as is possible. The farm is not well managed unless the work is so arranged that plenty of time is available to properly harvest and care for the harvested crops. There is no special advantage in growing crops unless you properly harvest and care for the crop.

Our farmer has thought it well to employ a hired man throughout the month and extra help for the house the last half of the month.

On the 1st and 2d of the month the sugar beet, potato, and corn-fields received their second cultivation. From the 6th to 11th, inclusive, the second irrigation of the alfalfa field of 15 acres, one alfalfa pasture of $2\frac{1}{2}$ acres, 7 acres of wheat, and 15 acres of oats was done. The 12th to 14th, inclusive, was spent in cultivating; the 15th to 17th, inclusive, in irrigating; and the 20th, 21st, and 22d in cultivating again. The remainder of the month was taken up in putting in the stack the second cutting of alfalfa.

The close of the month finds the farmer with all crops in good shape to permit full attention to the harvest of the grain, which is ripening and which will be ready for cutting early in August.

Business transactions during the month were as follows:

Cash on hand July 1, 1915-----	\$116. 46
Cash received:	
Ice sold, 1,200 pounds, at 30 cents per hundredweight-----	3. 60
One boar pig to Sam Wright-----	18. 00
Butter fat sold creamery, 60 pounds, at 24 cents-----	14. 40
Eggs sold commission company, 32 dozen, at 23 cents-----	7. 36
	————— \$159. 82

Cash paid out:

June, 1915, bill at store.....	\$29. 25
Paid lumber company to close account.....	39. 30
Cash for personal use of family.....	25. 00
Hired man during month.....	37. 50
Hired girl, two weeks.....	7. 50
	<hr/> \$138. 55

Cash on hand Aug. 1, 1915..... 21. 27

The account with the bean field stands at the close of July, 1915, as follows:

Charges brought forward July 1, 1915.....	\$43. 50
July 12, cultivating.....	3. 50
July 15, irrigating.....	2. 00
July 20, cultivating.....	3. 50
July 22, hand pulling weeds.....	2. 00
	<hr/>
Total cost to date, July 31, 1915.....	54. 50

AUGUST ACCOUNT.

Heavy rains early in August have interfered with the farm work and delayed the full ripening of the small grain. During the first week of the month no field work could be done and advantage was taken of this slack time to make stack bottoms on which to stack the wheat and oats as early as possible after cutting.

During the second week of the month the beans, sugar beets, potatoes, and corn were given a shallow cultivation to break up the soil crust and prevent escape of the moisture.

After cutting the second crop of alfalfa late in July it was decided to give the 38 pigs saved from the original 42 from 6 sows the run of the 15-acre alfalfa field. While this would reduce the third cutting somewhat, the best possible use would be made of the alfalfa consumed. It was arranged to give these pigs a small portion of ground grain daily.

On the 18th the two fields, 7 acres, of wheat were cut and shocked. The binding of this wheat was hired done, as our farmer has no binder of his own. This enabled our farmer to immediately follow the binder with a double-disk harrow set to run shallow. It is expected to fall plow this land, and this disking behind the binder served the double purpose of heading off weed growth and holding the soil in good shape for plowing until after the wheat is stacked.

On the 26th the oat crop was cut. The binder was not followed by the disk harrow, as it is planned to run the sheep in this field to gather up the "down" oats and utilize the feed available along fences and ditch banks.

The help hired during the month consisted of a man $1\frac{3}{4}$ days in grain shocking and a girl throughout the month in the house.

The business transactions for the month are as follows:

Cash on hand Aug. 1, 1915-----	\$21. 27
Cash received during August:	
Ice sold during the month, 850 pounds, at 30 cents-----	2. 55
Aug. 31, butter fat, 52 pounds, at 25 cents-----	13. 00
Aug. 31, eggs to commission company, 26 dozen, at 25 cents--	6. 50
Aug. 31, young chickens sold, 2 dozen, at 30 cents each-----	7. 20
	<hr/> \$50. 52
Cash paid out during August:	
Hired man, 1 $\frac{3}{4}$ days, shocking grain, at \$2 a day-----	3. 50
For binding wheat and oats, 22 acres, at \$1-----	22. 00
Hired girl for month-----	15. 00
	<hr/> 40. 50
Cash on hand Sept. 1, 1915-----	10. 02

Our farmer has not this month been able to pay his monthly store bill and has arranged for the merchant to carry the account until after harvest.

The account with the bean field at the close of the month stands as follows:

Charges brought forward Aug. 1, 1915-----	\$54. 50
Aug. 13, cultivating, one day-----	3. 50
	<hr/>
Total cost to Aug. 31, 1915-----	58. 00

SEPTEMBER ACCOUNT.

September has been a month of harvest with our farmer. The first six working days were taken up in handling the third cutting of alfalfa, which completed the work on that crop for the year. During the second week the beans were cut and bunched and work of cutting and shocking the corn started. During the third week the work in the cornfield was completed and the 2 acres of potatoes were dug and sorted. Three hundred and twenty bushels of marketable potatoes were secured from the 2 acres, and due to the uncertainty of getting a good price for stored potatoes one-half the crop was sold as soon as sorted for \$1 per hundred pounds. The fourth week was spent in helping neighbors with thrashing, and on the 28th the home thrashing, including the beans, was done. The 7 acres of wheat averaged 37 bushels per acre and the 15 acres of oats 64 bushels per acre. The beans yielded 20 bushels per acre. These were hauled to a neighbor's and put through a fanning mill, and from there 90 bushels were taken to market at \$2.40 per bushel. The wheat and oats were stored on the farm. The bean and oat straw was carefully stacked for use as feed and bedding for the live stock.

The farmer made the following entries in his account book for September:

Cash on hand Sept. 1, 1915.....	\$10. 02	
Cash received during September:		
1 bull calf to Sidney Parker.....	50. 00	
2 turkey gobblers to Valley Poultry Farm.....	8. 00	
1 boar pig to James Black.....	20. 00	
160 bushels potatoes, at \$1 per hundredweight.....	96. 00	
90 bushels beans, at \$2.40 per bushel.....	216. 00	
50 pounds butter fat, at 26 cents.....	13. 00	
28 dozen eggs, at 27 cents.....	7. 56	
		\$420. 58
Cash paid out during September, 1915:		
Family for personal expenses.....	75. 00	
Store bill for July and August.....	70. 70	
Thrashing 100 bushels beans, at 10 cents.....	10. 00	
Thrashing 259 bushels wheat, at 5 cents.....	12. 95	
Thrashing 960 bushels oats, at 3 cents.....	28. 80	
Hired help in house.....	20. 00	
Rental of potato digger.....	1. 00	
Hired help in fields, 6 days' haying, 1 man, at \$2.50.....	15. 00	
		233. 45
Cash on hand Oct. 1.....		187. 13

The account with the bean field has been closed with this month and stands as follows:

Charges brought forward to Sept. 1.....	\$58. 00	
Pulling and bunching.....	10. 00	
Thrashing	10. 00	
Item to cover miscellaneous labor and attention throughout season	10. 00	
Cleaning	5. 00	
Total charges.....	93. 00	
Credit by sale 90 bushels, at \$2.40.....	216. 00	
Credit by 10 bushels stored on farm, at \$2.40.....	24. 00	
		\$240. 00
Deduct total charges against crop.....		93. 00
Profit.....		147. 00

The farmer has allowed himself full wages for all labor and full cost for all materials and supplies used on this crop, so the profit shown for the 5 acres is the return he receives for the use of his land and his supervision of the work.

OCTOBER ACCOUNT.

October is a between-seasons period for most farmers. During this season the good farmer looks to the repair of the farm buildings, the careful housing of all implements needed no more until next season, and the provision of additional quarters and shelter for the increase in live stock.

Our farmer during the first of the month pulled the 3 acres of beets, getting a total yield of 40 tons. About 5 tons of these were

put in a pit to be fed during the winter to the live stock and poultry. The remaining 35 tons were sold to the sugar factory for a credit of \$192.50.

To provide for the fall litters of pigs—expected late in October or early in November—a comfortable but inexpensive hog house was built during the month.

Of the 37 spring pigs on hand 4 are being kept for use as brood sows and the remaining 33 have been turned into the beet fields to utilize the tops for roughage. They will be fed corn from the field adjoining to make out the fattening ration.

Of the 10 lambs secured in the spring 9 have been saved, and these the farmer has sold this month: he does not plan to keep more than about 10 sheep on his farm. The lambs weighed 80 pounds each and sold for 7 cents per pound.

With the idea of increasing his dairy work the next season he has bought two 2-year-old heifers at \$80 each.

Our farmer made the following entries in his accounts for October, 1915:

Cash on hand Oct. 1, 1915.....	\$187. 13
Cash received during October:	
6 dozen eggs, at 35 cents.....	2. 10
21 pounds butterfat, at 26 cents.....	5. 46
9 lambs, 720 pounds, at 7 cents.....	50. 40
35 tons sugar beets, at \$5.50.....	192. 50
	<hr/> \$437. 59
Expenditures during October:	
Family for personal expenses.....	35. 00
Store bill for September, 1915.....	24. 00
Lumber and material for hog house.....	55. 00
Hired help in house.....	15. 00
Two 2-year-old heifers, at \$80.....	160. 00
Hired help in fields, 3 days, at \$2.....	6. 00
	<hr/> 295. 00
Balance on hand Oct. 31.....	142. 59

NOVEMBER ACCOUNT.

The field work is over for the season, and the farmer is devoting his entire time to the care of his live stock, farm equipment, and improvements.

On the average farm it is not feasible to distribute the season's work evenly over the 12 months. A carefully planned crop rotation and proper balance of live stock will do much, however, to relieve the pressure from a few months during the summer.

The frequently repeated maxim of a certain successful farmer of the "old school" is "It is a poor farmer who does not have plenty of work to do on his own farm every day in the year." The days of

the late fall may be well taken up in properly caring for the orchard, the small fruits, the shrubs, and flowers. Fruits and flowers mean much to home life on the farm. The good farmer sees that all these are properly provided by mulches and other protection to withstand the hard winter. On the condition in which the trees and shrubs start out in the spring depend the yields in fruits and flowers.

The late fall is also a good time for a thorough cleaning and disinfecting of poultry and hog houses, horse stables, and cow barns. It is folly to expect poultry and live stock to thrive in unclean and vermin-infested quarters. You need not expect reasonable returns for feed consumed unless you provide clean and comfortable quarters.

The cold weather is now driving the rats and mice from the fields into the farm buildings. Be sure your crops are stored safe from the depredations of these pests. If they are allowed free access to bins and cribs, they will eat much and waste more.

The business ability of the farmer is tested more by how he utilizes his crops than it is by how he produces them. Our farmer has been gradually increasing the ration of the hogs he is fattening with the view of marketing them in Décembre.

Early in November the 6 brood sows produced 39 pigs, of which 36 were alive at the close of the month. Considerable care and attention is being given these sows and pigs, to insure them being in good, thrifty condition before the winter becomes severe.

The wife started the season with a total of 7 old turkeys, and, due to much wet weather, has had poor success in raising the young. One young gobbler was sold earlier in the season, and there remains a surplus of 7, which were sold during November for holiday trade.

Very little has been sold from the farm during the month. The egg production has dropped to about what is required in the home. Due to very favorable weather, the milk production has held up strong.

The business transactions for the month are as follows:

Cash on hand Nov. 1, 1915.....	\$142. 59	
Cash received during November:		
7 turkeys, 85 pounds, at 20 cents.....	17. 00	
27 pounds butter fat, at 26 cents.....	7. 02	
100 pounds onions.....	1. 40	
		\$168. 01
Expenditures during November:		
Family for personal expenses.....	25. 00	
Store bill for October.....	19. 00	
Doctor's bill.....	8. 00	
		52. 00
Cash on hand Dec. 1, 1915.....		116. 01

DECEMBER ACCOUNT AND INVENTORY.

For the purpose of starting new work on farm accounting the series of short articles on the theoretical farm which have been furnished in the preceding pages will be concluded in this section. The work has been carried through the busy portion of the year, and accounts for the few inactive months would not be important. For the purpose of comparison the inventory given April 1 is here repeated and an inventory of date January 1, 1916, is given.

The business transactions for the month of December are as follows:

Cash on hand Dec. 1, 1915_____	\$116. 01
Cash received during December:	
20 pounds butter fat, at 27 cents_____	5. 40
9 dozen eggs, at 40 cents_____	3. 60
30 hogs, 200 pounds each, at 6 cents per pound_____	360. 00
	<u>\$485. 01</u>
Expenditures during December:	
Family personal expenses_____	30. 00
Store bill for November_____	23. 40
Doctor bill _____	7. 50
Interest to Jan. 1 on \$1,100 note_____	58. 65
Paid on \$1,100 note_____	100. 00
Building charge to Government_____	33. 60
Taxes_____	54. 00
Fire insurance_____	25. 00
Life insurance_____	74. 00
	<u>406. 15</u>
Cash on hand Jan. 1, 1916_____	78. 86

Three of the 33 hogs which were being fattened were killed for family use. The first of the new year finds the farmer with but little cash in hand. He is, however, free from debt with the exception of his December store bill and the note of \$1,000 at the bank. He has plenty of stock feed on hand and a good quantity of supplies for family uses. He will have a small income during the remainder of the winter from dairy and poultry products. He has 35 pigs which he will probably market the following June or July to obtain funds for the next season's work. He has prepared the way for more profitable farming the next season. Instead of 6 brood sows he now has 10, and he will have 6 milch cows as against 3 for the past year.

The accompanying statement gives an inventory for the two dates named.

ASSETS.

Items.	Apr. 1, 1915.	Value.	Jan. 1, 1916.	Value.
Farm and improvements.....		\$4,800.00		\$5,000.00
Cash in bank.....		120.00		78.86
Wheat.....	100 bushels, at \$1.....	100.00	220 bushels, at 80 cents..	176.00
Beans.....			10 bushels, at \$2.40.....	24.00
Alfalfa.....	18 tons, at \$5.....	90.00	55 tons, at \$5.....	275.00
Potatoes.....	100 bushels, at 30 cents..	30.00	140 bushels, at 30 cents..	42.00
Corn.....	95 bushels, at 60 cents..	57.00		
Fodder.....			In shocks.....	40.00
Oats.....	300 bushels, at 40 cents..	120.00	900 bushels, at 35 cents..	315.00
Sugar beets.....			5 tons, at \$5.....	25.00
Miscellaneous produce.....		100.00		180.00
Brood mares.....	3, at \$185.....	555.00	3, at \$185.....	525.00
Colts.....	2, at \$75.....	150.00	2, at \$70.....	140.00
Driving horse.....	1.....	150.00	1.....	135.00
Milch cows.....	3, at \$80.....	240.00	3, at \$75.....	225.00
Heifers.....	1, at \$35.....	35.00	1, at \$55.....	55.00
Do.....			2, at \$80.....	160.00
Brood sows.....	6, at \$25.....	150.00	10, at \$25.....	250.00
Pigs.....			35, at \$2.50.....	87.50
Sheep.....	10, at \$5.....	50.00	10, at \$5.....	50.00
Chickens.....	125, at 50 cents.....	62.50	150, at 50 cents.....	75.00
Turkeys.....	7, at \$2.50.....	17.50	7, at \$2.50.....	17.50
Wagon.....	1.....	55.00	1.....	45.00
Plow.....	1.....	30.00	1.....	25.00
Disk.....	1.....	22.50	1.....	118.50
Cultivator.....	1.....	12.00	1.....	0.00
Harrow.....	1.....	8.00	1.....	27.00
Mower.....	1.....	35.00	1.....	7.50
Hay rake.....	1.....	20.00	1.....	16.00
Buggy.....	1.....	50.00	1.....	40.00
Miscellaneous equipment.....		175.00	Miscellaneous equipment.....	150.00
Accounts receivable.....		77.50		
Total assets.....		7,312.00		8,214.86

LIABILITIES.

	Apr. 1, 1915.	Jan. 1, 1916.
Note at bank with accrued interest.....	\$1,216.00	\$1,000.00
Due United States on building charge.....	1,680.00	1,646.40
Due lumber company.....	124.30	
Account at store.....	73.20	19.00
Total liabilities.....	3,093.50	2,665.40
Total assets.....	7,312.00	8,214.86
Total liabilities.....	3,093.50	2,665.40
Net worth.....	4,218.50	5,549.46
Apr. 1, 1915.....		4,218.50
Net gain.....		1,330.96

This inventory would show a net gain from April 1, 1915, to January 1, 1916, of about \$1,300. From this net gain there should be deducted the amount represented by the feed which would be consumed by nonproductive animals and the family expenses up to April 1, 1916. The result would be a net gain of from \$600 to \$700 for the year's work. This looks small, of course, to the "back to the landers," but it is fully up to the average. It must be considered that the farmer has had a living for himself and family, has been able to

hire much work done, and has put himself in shape for better returns the following years.

CASH ACCOUNTS.

It is probable that with the farmer the most important business record is the account of receipts and expenditures, ordinarily called the cash account.

If the farmer goes no further in bookkeeping than keeping an accurate cash account he will have a basis for determining the costs of operating and returns from the various departments of his farm work. Many attempt to record all cash transactions on the stubs of check books, but this make an unsatisfactory record. Some particularly progressive banks have provided check books with large stubs ruled to permit the farmer to itemize deposits and expenditures in detail. Such an arrangement is better than the ordinary check stub record, but it is inconvenient for the reason that in order to determine what has been deposited for any special account or what has been checked out for any particular account it is necessary to examine the stubs of many checks. The old-fashioned single or double column cashbook is likewise inconvenient, for unless all the entries be posted to the ledger accounts it is considerable trouble to determine what has been spent or collected for any special items.

Probably the most convenient form of cash account, and one that is at the same time simple and labor saving, is that provided by what is called the multiple-column cashbook, shown in the accompanying illustration.

Multiple-column cashbooks may be purchased with few or many columns, and the farmer may choose between them according to the number of departments of his farm work on which he desires to keep records. Usually one farmer has but four or five principal departments of his business on which he cares to keep posted, and all other receipts or expenditures may be carried to a "sundries" or "miscellaneous" column. The advantage of this form of cash account is, as indicated, that the amount taken in from any special department or the amount paid out for any particular department may be determined quickly at any time. If a ledger is also kept this form of cashbook saves much posting from the cashbook to the ledger, as, for example, the total for one month of the "dairy" column may be posted to the "dairy" account in the ledger instead of posting all the items in that column.

CASH ACCOUNT.

RECEIPTS.

Date.	Received from—	Dairy.	Hogs.	Wheat.	Oats.	Poultry.	Total.
1916. Jan. 2	Doc creamery, cream and eggs.....	\$8.10	.....	.....	.....	\$1.40	\$9.50
8	James elevator, 100 bushels wheat and 300 bushels oats.....	.....	.....	\$100	\$150	.....	250.00
20	Doc creamery, cream.....	9.00	.....	.....	.....	.....	9.00
27	Ames Packing Co., hogs, 8,500 pounds.....	.....	\$425	.....	.....	.....	425.00
	Total for January, 1916.....	17.10	425	100	150	1.40	693.50

EXPENDITURES.

Date.	Check No.	Paid to—	Dairy.	Hogs.	Wheat.	Poultry.	Miscellaneous.	Total.
1916. Jan. 3	21	J. Smith, hired help.....	\$8.00	\$6	.....	\$3	\$13.00	\$30.00
8	22	Owens Merchandise Co., December bill.....	1.50	4	.....	.....	17.00	22.50
10	23	Ames Hardware Co., December bill.....	2.20	.....	.....	.....	1.50	3.70
14	24	Dr. Sommers, care of son.....	.....	.....	.....	.....	10.00	10.00
18	25	Wm. Jones, hauling wheat.....	.....	.....	\$6	.....	.....	6.00
		Total for January, 1916.....	11.70	10	6	3	41.50	72.20

PERSONAL ACCOUNTS.

Many neighborhood grudges grow out of little matters connected with farming operations, and not a few are traceable directly to such items as "The day's work at thrashing that Jones owes me for," "the bushel of wheat I charged to Smith and am still charging," and "the rent Black owes for use of my drill."

If every farmer knew that every farmer kept books, there would be fewer misunderstandings about these little business matters. In the old days it was common—so we are told—for neighbors to help each other without keeping a record of or expecting pay for extra days' work on thrashing, haymaking, or such. Not so these days. Every farmer is entitled to and should receive returns for every hour he works for his neighbor and for each accommodation in the way of materials or use of equipment.

If you keep a ledger, open up an account with each neighbor with whom you do business. Charge him with what he gets from you and credit him with what you get from him, and show him this record when you settle up with him. If you do not keep a regular ledger, you should have some kind of a book in which to keep personal accounts. A written record of transactions made at the time of the transactions will save disputes later on.

If you wish to stay on good terms with your neighbors, keep books with them. It will probably lead them to keeping books with you, which is a condition to be desired.

CREDITS.
SALES.

Date.	Kind.	Number or weight.	Price.	Total.
Total sales.....				

INVENTORY AT CLOSE OF YEAR.

Total inventory..				
Total credits.....				
Total debits.....				
Balance.....				

Space in accordance with the volume of the business to be handled by the farmer may be provided under each of these several headings. Where the farmer makes a business of raising pure-bred hogs and selling them for breeding purposes he may desire to keep books with this feature of the business, and in this case it will be necessary to amplify his accounts to meet the requirements. As a starter, however, it is thought that if the farmer will keep strict account of his hog business as a whole an important step will be taken.

DAIRY ACCOUNTS.

It seems to have become the custom to refer to unprofitable dairy cows as "boarders." Now comes a farmer who insists that these unprofitable cows be called "relatives" instead of "boarders" on the ground that boarders usually pay for their board and relatives never do. The object, then, of keeping dairy accounts is to determine whether you are supporting a bunch of relatives.

On the average farm where just enough cows are kept to supply the family with milk the farmer will hardly care to keep special dairy accounts, but will be content to judge his cows by the fullness of the milk pail and the value of the calves produced.

Where a considerable portion of the farm work and the bulk of the farm crops are applied to dairying, it is well to know what returns are being secured from each cow and from the dairy work as a whole.

The method of keeping individual cow records by weighing the milk at each milking and testing the same regularly for butter-fat content is well understood, and these records are necessary to determine what each cow is doing in the way of production.

Just as important as a knowledge of what you get from the cow is a knowledge of what you feed the cow and the value of this feed. Some dairymen go so far as to feed each cow an individual ration, different from that fed any other cow and based on a knowledge of just what food each cow needs to enable her to produce the most milk. As a rule, however, cows are fed the same ration, though it is varied in amount to correspond with the size of the cow and the amount of milk produced. This makes the cost keeping more simple, and satisfactory accounts may be made.

If possible, feed bins to hold feed exclusively for the milch cows should be provided. Feed may be weighed or measured into these bins in considerable quantities, which simplifies the determination of the amount of grain and other feeds utilized by the cows.

The same is true of the pasture. If pasture for the exclusive use of the dairy herd is available, it is easy to determine the charge against the dairy for pasturage. Exclusive pastures for cows, on irrigated farms, are not considered most economical, however, and in the interests of the best use of all the feed available it is good business to use the pasture to the best advantage, even though the accounts are a little complicated.

It is necessary to charge the dairy account with depreciation on the mature cows. This is determined by the estimated useful life of the cow and the value of the cow for beef after her dairy work is done. For example, if a cow is worth \$100 as a 2-year-old and her useful life is estimated at six years, with her value for beef placed at \$50 at the end of six years, it is necessary to charge off each year one-sixth of the \$50 depreciation. It is also necessary to credit the dairy account with the calves produced and the manure made.

The accompanying rough outline is suggested for dairy accounts. This may be changed in details to suit the conditions on each farm.

DAIRY ACCOUNT.

DEBITS.

INVENTORY AT BEGINNING OF ANNUAL OR SEMIANNUAL PERIOD.

Date.	Kind.	Number.	Value each.	Total.
.....
.....
.....
(Provide space in accordance with the various ages, kinds, and breeds of cows.)				
Total.....
Total inventory.....
Total inventory..

EXPENSES.

Date.	Grain and mill feeds.	Hay and forage.	Pasture.	Silage.	Labor.	Insurance and mis- cella- neous.	Total.

(Provide space sufficient for annual or semiannual records.)

Total.....							
Total expenses.....							
Total debits.....							

CREDITS.

RECEIPTS.

Date.	Cream.	Butter.	Skim milk.	Manure.	Calves.	Miscella- neous.	Total.
January.							
1-7.....							
8-14.....							

(Provide sufficient space for semiannual or annual records.)

Total.....							
Total receipts.....							

INVENTORY AT CLOSE OF ANNUAL OR SEMIANNUAL PERIOD.

Date.	Kind.	Number.	Value each.	Total.	

(Provide space in accordance with the various ages, kinds, and breeds of cows.)

Total.....					
Total inventory.....					
Total credits.....					

SUMMARY.

Total credits.....	\$.....
Total debits.....	\$.....
Net gain.....	\$.....

HORSE ACCOUNTS.

If we are to believe the statements made by the manufacturers of the 57 varieties of farm tractors, it is an utter waste of time to keep horse accounts. The tractor people are busy on that and they have figured out to a cent just how much the farmer loses on each horse he owns. However, we may as well assume that the statements made by tractor salesmen are for the purpose of selling tractors and are not to be considered as especially favoring horses, which so many of us find necessary on our farms.

The question of whether to use tractors or horses for farm power has had consideration on the part of many practical men, and it is the generally accepted opinion that the tractor is not a necessity on farms up to 160 acres in area, whereas the horse is a necessity, so we may as well do a little cost keeping with the horse in order that it may receive due credit for what it does.

Horses should be charged with all work performed for them, their keep, losses, and depreciation; they should be credited with all work performed by them, their increase, and the manure produced by them.

Space will not be taken here to outline the forms on which to keep these accounts, as the forms would follow closely those used for cattle, hog, or sheep accounts, and would be varied to suit the operations on different farms.

To start with, it will be found that brood mares properly handled will show better returns than geldings and mules. There are many cases where mares have been bought at 2 or 3 years of age, used to produce several times their value in colts, pay their way by work, and sell at 6 to 10 years of age at nearly the original cost. Increases in the value of horses have something to do with cases such as these, of course, but it is a demonstration of the small depreciation that takes place in good mares and the returns that may be secured under farming conditions as they exist.

One of the principal benefits of keeping horse accounts is that it is possible to determine at just what seasons of the year the horses are used to best advantage and when the horses are fully idle. A knowledge of the exact work performed by the horses is a help in rearranging the work on the farm to provide continuous employment for the horses and man labor.

The horse deserves more credit than it receives at the hands of farm tractor salesmen and from publishers of farm papers who are anxious to secure the advertisements paid for by tractor manufacturers. Don't go back on the horse; you will need its help for years to come.

HAY ACCOUNT.

The old saying that "figures do not lie" is now generally understood to imply that figures in themselves are not capable of falsity, but that they will readily lend themselves to manipulation. This is particularly pertinent in connection with the "studies," "investigations," "experiments," and "tests" of the comparative value of various live-stock feeds.

For example, Mr. "A," who is a booster of corn, will show that by feeding alfalfa and corn to hogs and allowing the market price for the alfalfa, corn is worth \$2 per bushel as hog feed. Mr. "B," who is a booster of alfalfa, will take the same feeding test and by allowing the market price for the corn will prove that alfalfa is worth \$20 per ton as hog feed. If Mr. "C" would come along as a booster of water as a pork producer he could show, by allowing the market price for both the alfalfa and corn, that water is worth \$2 per barrel. Mr. "D" could allow the market price for alfalfa, corn, and water and prove that 10 square feet of bare ground is worth a fabulous price as a hog resort. By carrying this line of reason, or unreason, a little further, you can cash in on the fresh country air, the scenery, and the country boy's whistle.

Reading reports of such "demonstrations," "comparative tests," "food-value investigations," etc., is an interesting pastime, but with the farmer, who has to strike a balance between returns from all his crops, live stock, etc., and his bank account at the end of the year, such juggling of figures is not attractive.

The most successful feeders are those who make the greatest use of the cheapest feeds, food value considered. It is folly to buy high-priced grains and feed them heavily when the same results may be obtained by feeding a great deal of cheap alfalfa with a little grain.

On our irrigation projects alfalfa hay is the major item of our live-stock rations. We ought to know what the alfalfa we feed costs us, and the only way we can determine this is to keep a hay account. When you go to buy feed from a neighbor or a merchant, one of the important considerations is the price and whether you can afford to feed it to your live stock. You should be just as careful to know what you are paying for the hay you produce on your own land. If you think your alfalfa has cost you only \$3 per ton, you will probably be a little careless about its use. If you know by actual accounting that it has cost you \$5 per ton, you will use it to better advantage.

Keeping a hay account is a simple matter. If you let alfalfa stand for four years, you should divide the cost of seeding by four and charge one-fourth to each year's crop. Then there is a reasonable rental for the land, labor, renovating, irrigating, and putting up the

hay, as well as a due proportion of the general farm expense, all to be charged to the hay account. Without much trouble you can tell approximately how much each ton of hay in the stack has cost you.

GRAIN ACCOUNTS.

Of the ordinary field crops it is probably most important to keep accounts with the grain crops. Many farmers raise wheat and oats year after year for returns that do not pay good wages for the labor involved, to say nothing of the wear and tear on horses, machinery, land, and the farmer.

For example, if a yield of 35 bushels of oats per acre is secured, which is about the five-year average in this country, and the crop is sold for 35 cents per bushel, which is also about the five-year average in this country, the gross returns per acre would be \$12.25. If we allow \$5 per acre for use of the land, \$1 per acre for seed, \$2 for binding and thrashing, \$1 for delivery of irrigation water, we would have left the munificent sum of about \$3 to pay for the farmer's labor, wear, and tear on horses and machinery, fertilizer used or fertility taken from the soil, and to contribute to the installments on the grand piano and the automobile.

The average small-grain crop on the average American farm is not a paying proposition, due mostly to faulty crop rotation and insufficient fertilization, coupled with poor cultivation. By keeping a reasonably accurate account of all the expenses entering into a small-grain crop the farmer will be brought to realize that he must change his methods if he is to be justified in continuing in raising small grains.

You don't need any special ruled form to keep a grain account. Just put down on one side of the page your labor charges and other expenses in producing the crop and on the other side your returns from the crop, and you can easily tell whether you are raising wheat, oats, and other small grains at a profit.

FARM ACCOUNTS, HESPER FARM.

In meeting with farmers on the several projects and in talking to farmers' meetings I have often referred to the operation of my own farm in order that I might give first-hand information and relate facts rather than theory. I am often asked for a statement of how my farm is operated and am submitting a brief statement of the Hesper farm business.

HESPER FARM STATEMENT, PERIOD APR. 1, 1915, TO MAR. 31, 1916.

	Gross re- turns.	Costs.	Gross gains.
Ranch account.....	\$10,978.97	\$6,929.32	\$4,049.65
Sugar-beet account.....	16,573.45	11,307.39	5,266.06
Sheep account.....	32,679.66	27,954.54	4,725.12
Total.....	60,232.08	46,191.25	14,040.83
General expense:			
Taxes.....		838.42	.....
Miscellaneous.....		301.59	.....
Water assessments.....		320.00	1,460.01
Net gain.....			12,580.82
Investment:			
640 acres improved land.....		97,500.00	.....
Work stock and equipment.....		12,833.00	110,333.00
Net gain on total investment (per cent).....			11.4

The farm was divided as follows:

	Acres.
Sugar beets.....	173
Grain.....	100
Alfalfa.....	300
Pasture.....	15
Beans, peas, corn.....	20
Roads and ditches.....	20
Garden and orchard and trees.....	7
Buildings and grounds.....	5
Total.....	640

Only two special accounts, the sheep account and the sugar-beet account, were kept. These two departments are especially featured and it is important to know what they return.

The general ranch account receives credit for all feed, hay, grain, etc. (excepting sugar-beet tops), used by the sheep and for all sales of hogs, poultry, beans, peas—in short, all items not credited to the sugar beet or sheep accounts—the ranch is charged with all expenses not charged to the sugar beet and sheep accounts, excepting taxes, water assessments, and sundries which are charged to all accounts.

The sugar-beet account is charged with its proportion of labor and all proper charges including manure.

The sheep account is charged with the purchase price of the sheep, interest on this purchase price, hay from the ranch at \$5 per ton, pasture, sugar-beet tops at \$5 per acre. Charging all feeds excepting alfalfa hay in at cost, the sheep return \$15 per ton for the hay used. They also pay \$1,400 for the pasture secured from the fields after all crops are harvested.

In determining the investment involved the land is valued at about \$150 per acre which is the maximum for this section. Work stock and equipment are put in at actual value. It requires 32 head of work horses to handle the work. No tractors are used.

About one-half the farm is kept in alfalfa, which for 1915 yielded about 1,200 tons, and this is all fed on the place. About 2,000 tons or 1,000 spreader loads of manure are secured each year, and this is spread on 80 acres of sugar-beet ground.

The plan of rotation is alfalfa three to six years, sugar beets three years, small grain one year, and then back to alfalfa. Small fields are in crops such as peas, beans, corn, etc., but these do not affect the general rotation.

The 173 acres of sugar beets averaged about 15 tons per acre, and the average price received was about \$6 per ton.

In the small grains 80 acres of oats averaged a little over 100 bushels per acre and the 20 acres of wheat upward of 50 bushels per acre.

Beans, grown and sold for use as garden seed, averaged 25 bushels per acre for the 10 acres and sold at 7 cents per pound. This is above average price, due to extraordinary market conditions.

Peas averaged 25 bushels per acre for 5 acres.

Corn, 5 acres, did not mature.

During the past season 6,000 sheep were bought for feeding and were sold as finished from October 1 to April 1.

Six milch cows are kept; about 75 head of Poland China hogs are raised each year; about 500 chickens are raised for home use; and a small band of breeding ewes is kept on the place.

All straw and roughage is run through the feed lots for feed and manure.

The farm buildings represent about 10 per cent of the value of the land and improvements, or \$10,000.

Workmen are paid \$40 per month with board, and one foreman receives \$1,000 per year and board.

In the interests of brevity many details are omitted, but I shall be pleased to answer inquiries from anyone desiring further information on any point.



